

Retrofitting Nebraska 2015



Standard Work Specifications

Field Guide for

Manufactured Housing

created by

Nebraska Weatherization Assistance Program

2 Health and Safety

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2.0100.2b

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Durable and wrist-protecting gloves will be worn that can withstand work activity

Objective(s):

Minimize skin contact with contaminants

Protect hands from sharp objects

2.0100.2c

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

If the risk of airborne contaminants cannot be prevented, proper respiratory protection will be provided and worn (e.g., N-95 or equivalent face mask)

When applying low pressure 2-component spray polyurethane foam, air purifying masks with an organic vapor cartridge and P-100 particulate filter will be used

Objective(s):

Minimize exposure to airborne contaminants (e.g., insulation materials, mold spores, feces, bacteria, chemicals)

2.0100.2d

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

If contaminants are present (e.g., insulation materials), removable protective clothing will be worn

Eye protection will always be worn (e.g., safety glasses, goggles if not using full-face respirator)

Objective(s):

Protect worker from skin contact with contaminants

Minimize spread of contaminants

Provide eye protection

2.0100.2e

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Spaces with limited ingress and egress and restricted work area will be considered confined space

Access and egress points will be located before beginning work

Inspection will be conducted for hazards, such as damaged or exposed electrical conductors, mold, sewage effluent, friable asbestos or fiberglass, pests, and other potential hazards

Adequate ventilation will be provided

Use of toxic material will be reduced

Objective(s):

Provide adequate access and egress points

Reduce risk to the workers in the confined space

Prevent buildup of toxic or flammable contaminants

Prevent electrical shock

2.0100.2f

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Power tools will be inspected and used in accordance with manufacturer specifications to eliminate hazards associated with missing ground prongs, ungrounded circuits, misuse of power tools, noise, and improper or defective cords or extension cords

All devices used will be verified as GFCI protected or double insulated

Exhaust gases from compressors and generators will be prevented from entering interior space

Objective(s):

Prevent power tool injuries

Prevent buildup of toxic or flammable contaminants

2.0100.2g

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

The least toxic suitable material will be chosen

Hazardous materials will be handled in accordance with manufacturer specifications or MSDS standards to eliminate hazards associated with volatile organic compounds (VOCs), sealants, insulation, contaminated drywall, dust, foams, asbestos, lead, mercury, and fibers

Appropriate personal protective equipment (PPE) will be provided

Workers will be trained on how to use PPE

Workers will be expected to always use appropriate PPE during work

Objective(s):

Prevent worker exposure to toxic substances

- The costs associated with the handling of, or training associated with the handling of, hazardous materials are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0100.2h

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Appropriate PPE will be used (e.g., knee pads, bump caps, additional padding)

Proper equipment will be used for work

Proper lifting techniques will be used

Objective(s):

Prevent injuries from awkward postures, repetitive motions, and improper lifting

2.0100.2i

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Hand tools will be used for intended purpose

Objective(s):

Prevent injuries

2.0100.2j

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Caution will be used around power cords, hoses, tarps, and plastic sheeting

Precautions will be taken when ladders are used, when working at heights, or when balancing on joists

Walk boards will be used when practical

When scaffolding is used, manufacturer set-up procedures will be followed

Appropriate footwear and clothing will be worn

Objective(s):

Prevent injuries due to slips, trips, and falls

2.0100.2k

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Ensure staff is aware of risks during summer months, including the symptoms of heat stroke and heat exhaustion

Appropriate ventilation, hydration, rest breaks, and cooling equipment will be provided

911 will be dialed when necessary

Objective(s):

Prevent heat stroke, heat stress, and cold stress related injuries

2.0100.2I

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Ignition sources will be identified and eliminated (e.g., turn off pilot lights, space heaters, and fuel supply)

Use of flammable material will be reduced and fire-rated materials will be used

Objective(s):

Prevent a fire hazard

2.0100.2m

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

The source of all contaminants (e.g., sewage, dead animals, needles) will be corrected, repaired, or removed before performing inspections that require complete access to the crawl space

If appropriate, the contaminant will be neutralized and/or a protective barrier will be installed in the area

Objective(s):

Ensure worker safety

Prevent worker exposure to hazards

2.0103.1a

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

All worker safety specifications in Global Worker Safety section will be followed

Objective(s):

Prevent injury

Minimize exposure to health and safety hazards

2.0104.1a

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

Follow all worker safety specifications in Global Worker Safety section

Objective(s):

Prevent injury

Minimize exposure to health and safety hazards

2.0104.1b

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

OSHA asbestos abatement protocol 29 CFR 1926.1101 will be followed if vermiculite insulation is present

If unsure whether material contains asbestos, a qualified asbestos professional will be contacted to assess the material and to sample and test as needed

When working around asbestos-containing material (ACM), the following will not be done:

- Dust, sweep, or vacuum debris
- Saw, sand, scrape, or drill holes in the material
- Use abrasive pads or brushes to strip materials

Attic insulation that looks like vermiculite (as opposed to fiberglass, cellulose, or urethane foams) will not be removed or disturbed

Objective(s):

Protect workers from toxic exposure

- Observe OSHA 29CFR 1926.1101 protocol when asbestos is suspected.
- The costs associated with the sampling and testing of suspected Vermiculite materials are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0104.1c

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

All materials will be handled in accordance with manufacturer specifications or Material Safety Data Sheet (MSDS) standards to eliminate hazards associated with incorrect, defective, or improperly used respirator and personal protective equipment (PPE)

Objective(s):

Protect workers from toxic exposure

2.0104.1d

Desired Outcome:

Work is completed safely without injury or hazardous exposure

Specification(s):

Presence of lead based paint in pre-1978 homes will be assumed unless testing confirms otherwise

The Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect workers and occupants from potential lead hazards

2.0105.3a

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

All worker safety specifications in Global Worker Safety section will be followed

Objective(s):

Prevent injury

Minimize exposure to health and safety hazards

2.0105.4a

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Follow all worker safety specifications in Global Worker Safety section

Objective(s):

Prevent injury

Minimize exposure to health and safety hazards

2.0105.4b

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Identify and dispose of any mercury-containing thermostats in accordance with Environmental Protection Agency (EPA) guidance

Objective(s):

Protect worker and occupant from mercury exposure

Paraphrased from 40 CFR 273.14: A universal waste mercury-containing thermostat or container containing only universal waste mercury-containing thermostats should be labeled or marked clearly with any of the following phrases: "Universal Waste-Mercury Thermostat(s)," "Waste Mercury Thermostat(s)," or "Used Mercury Thermostat(s)." **Contact thermostat-recycle.org or earth911.org for recycling options.

2.0105.4c

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Suspected asbestos hazards will be identified in furnaces (e.g., gaskets), wood stoves, zonal heating devices, electrical wiring insulation, boilers, and pipe insulation and corrected in accordance with EPA guidance

Workers will take precautionary measures to avoid exposure

Objective(s):

Protect worker and occupant from asbestos exposure

- The costs associated with the testing and remediation of Asbestos materials are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0105.4d

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Gloves will be worn when working with metal ducts

Workers will wear personal protective equipment (PPE) as needed to protect themselves against exposure to hazards (e.g., pests, sewage, flooded duct work, mold, chemicals, scat, viruses)

Long sleeves and long pants should be worn as additional protection from liquid nitrogen and other hazardous materials

Objective(s):

Protect worker from exposure to hazards

Protect worker from skin contact with liquid nitrogen

2.0105.4e

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Worker will check for presence of combustible gas leaks before work begins

Leaks will be repaired before work is performed

Objective(s):

Protect worker and occupant from exposure to hazards

2.0105.4f

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Workers will check for presence of ambient CO before and during work

CO issues will be addressed before work is performed or continued

Objective(s):

Protect worker and occupant from exposure to hazards

2.0105.4g

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Pipes will be sealed by a certified professional with an approved fastening process and sealant in accordance with manufacturer specifications (International Fuel Gas Code)

Gas lines will be leak free when tested with an electronic combustible gas leak detector and verified with bubble solution

OR

Gas lines will be leak free when tested by a standing pressure test that meets the approval of the local code

Objective(s):

Install gas lines with no leaks

2.0106.1a

Desired Outcome:

Work completed safely without injury or hazardous exposure

Specification(s):

Follow all worker safety specifications in Global Worker Safety section

Objective(s):

Prevent injury

Minimize exposure to health and safety hazards

2.0110.1a

Desired Outcome:

Occupant and worker risk from hazardous materials minimized

Specification(s):

Materials that do not create long-term health risks for occupants and workers will be used

Objective(s):

Improve indoor air quality in the living space

2.0110.1b

Desired Outcome:

Occupant and worker risk from hazardous materials minimized

Specification(s):

Manufacturer specifications will be followed

Objective(s):

Reduce risk of exposure to harmful substances

Follow safety procedures

2.0110.1c

Desired Outcome:

Occupant and worker risk from hazardous materials minimized

Specification(s):

MSDSs will be provided onsite and available during all work

Objective(s):

Assess exposure risk

Prepare a response in case of emergency

2.0111.5a

Desired Outcome:

Manufactured home is properly installed

Specification(s):

Any installation deficiencies that may affect worker safety or integrity or installed measures will be repaired before starting work

Objective(s):

Ensure site is safe and ready for upgrade

- The costs associated with repairing installation deficiencies are not eligible expenditures in the *Nebraska Weatherization Assistance Program*. When these issues are identified the client must be advised of the problem and the home shall be deferred as per the *Nebraska Weatherization Assistance Program's* deferral process.

2.0111.5b

Desired Outcome:

Manufactured home is properly installed

Specification(s):

Home must be stabilized in accordance with manufacturer specifications or local authority having jurisdiction

Objective(s):

Ensure the home is secured properly

Prevent injury

Minimize exposure to health and safety hazards

- The costs associated with repairing installation deficiencies are not eligible expenditures in the Nebraska Weatherization Assistance Program. When these issues are identified the client must be advised of the problem and the home shall be deferred as per the *Nebraska Weatherization Assistance Program's* deferral process.

2.0201.2a

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Combustion air will be provided from the outside and, where applicable, in accordance with the 2012 IRC for the type of appliance installed

Objective(s):

Prevent combustion byproducts from entering the house

2.0201.2b

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

If replacing appliances, a sealed-combustion, direct-vent appliance will be installed in accordance with manufacturer specifications, 2012 IRC G2427.8, and additional applicable codes

Replacement equipment venting will be assessed to ensure other existing equipment is not adversely affected

Objective(s):

Prevent combustion byproducts from entering the house

2.0201.2c

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

CO detection or warning equipment will be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in accordance with ASHRAE 62.2 and authority having local jurisdiction

Installation will be accomplished by a licensed electrician when required by local code

Objective(s):

Alert occupant to CO exposure

- The installation of Carbon Monoxide Detectors is required when none are present or the existing unit is inoperable and a combustion appliance(s) is present or the home has an attached garage. Battery operated or plug-in 110 Volt Detectors, located one per sleeping level and one adjacent to a combustion appliance, are eligible for reimbursement.
- Paraphrased from 2012 IRC R315: An approved CO alarm will be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which fuel-fired appliances are installed and in dwelling units that have attached garages. CO detectors will comply with UL 2075. Single-station CO alarms will comply with UL 2034 and will be installed in accordance with this code and the manufacturer's installation instructions. Per WPN 14-01, full compliance with ASHRAE 62.2.2013 and NFPA 720 is required.

2.0201.2d

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Gas ovens will be tested for CO

A clean and tune will be conducted if measured CO in the undiluted flue gases of the oven vent at steady state exceeds 200 ppm or 800 ppm by air-free measurement

Objective(s):

Ensure clean burn of gas ovens

- The costs associated with the tuning and cleaning gas ovens are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0201.2e

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Specify clean and tune if the flame has any discoloration, flame impingement, an irregular pattern, or if burners are visibly dirty, corroded, or bent

Objective(s):

Ensure clean burn and operation of gas range burners

- The costs associated with cleaning and tuning gas range burners are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0201.2f

Desired Outcome:

Buildup of dangerous combustion byproducts in the living space prevented

Specification(s):

Replacement of solid fuel-burning appliance with UL-listed and EPA- certified appliances if the existing appliance is not UL-listed or has signs of structural failure

Objective(s):

Ensure safe operations of solid fuel-burning appliances

- Mobile homes heated by naturally drafting combustion heating system that are not specifically manufactured for use in mobile homes shall not be weatherized until the heating system has been replaced with a heating system designed fo use in mobile homes.

2.0201.3a

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Emergency problems (e.g., gas leak, ambient CO levels that exceed 35 ppm) will be communicated clearly and immediately to the customer and appropriate solutions will be suggested

Objective(s):

Ensure system does not have fatal problems

2.0201.3b

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Inspect and test for gas or oil leakage at connections of natural gas, propane piping, or oil systems

If leaks are found, immediate action will be taken to notify occupant to help ensure leaks are repaired

The report will specify repair for leaks and replacement for hazardous or damaged gas or oil connectors and pipes

Objective(s):

Detect fuel gas leaks

Determine and report need for repair

2.0201.3c

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

The presence and operability of a draft regulator will be verified and tested

Combustion venting systems will be inspected for damage, leaks, disconnections, inadequate slope, and other safety hazards

Objective(s):

Determine if a regulator is present and working

Determine whether vent system is in good condition and installed properly

2.0201.3d

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Baseline pressure will be measured in Combustion Appliance Zone (CAZ) with reference to outdoors

Objective(s):

Measure pressure difference between combustion zone and the outside under natural conditions

2.0201.3e

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

CAZ depressurization testing will be administered on all natural draft equipment

Objective(s):

Measure combined effect of mechanical system fans on combustion zone

2.0201.3f

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Appliance spillage testing will be administered on natural draft appliances and shall not exceed 2 minutes

Objective(s):

Detect excessive spillage of combustion gases

2.0201.3g

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

CO will be tested for in undiluted flue gases of combustion appliances

For CO levels exceeding 100 ppm as measured or 200 ppm air-free measurement, service will be provided to reduce CO to below these levels (unless CO measurement is within manufacturer specifications)

If the outlet of the exhaust is accessible, include a CO test on all sealed- combustion and power-vented appliances (without atmospheric chimneys)

Objective(s):

Measure CO and report excessive levels

- Sealed combustion units shall be tested at the exterior exhaust vent in the undiluted flue gases. The tested flue gas CO will be divided by the number of burner chambers in the unit to determine the average ppm CO per chamber. If CO levels exceed 100 ppm as measured in the undiluted flue gases service will be provided to reduce CO levels, unless CO measurement is within manufacturer specifications.

2.0201.3h

Desired Outcome:

Accurate information about appliance safe operation is gathered

Specification(s):

Final combustion testing will be conducted at project completion to ensure compliance with the above specifications

Objective(s):

Ensure safe operation of combustion appliance within the whole house system after any repair project

- Backdraft testing shall be performed at the time of initial, Quality Control Inspection and at the end of each work day if the project will require more than one day, on all vented naturally drafting combustion appliances. Backdraft testing shall not be performed on solid fuel burning appliances.

2.0202.1a

Desired Outcome:

Elimination of combustion byproducts

Specification(s):

With the occupant's permission, unvented heaters will be removed, except when used as a secondary heat source and when it can be confirmed that the unit is listed to ANSI Z21.11.2

Units that are not being operated in compliance with ANSI Z21.11.2 should be removed before the retrofit but may remain until a replacement heating system is in place

Failure to remove unvented space heaters serving as primary heat sources has the potential to create hazardous conditions, and thus any further weatherization services will be reevaluated in the context of potential indoor air quality risks

Objective(s):

Eliminate sources of combustion byproduct within a living space

- Based on U.S. DOE WPN 11-6:
- Removal is required, except as secondary heat where unit conforms to ANSI Z21.11.2.
- Units that do not meet ANSI Z21.11.2 must be removed prior to weatherization but may remain until a replacement heating system is in place.

2.0202.1b

Desired Outcome:

Elimination of combustion byproducts

Specification(s):

Occupant will be educated on potential hazards of unvented combustion appliances (primary or secondary) within a living space

Objective(s):

Inform occupant about possible hazards associated with combustion byproducts and moisture

- Mobile homes primarily heated by naturally drafting combustion heating systems that are not specifically manufactured for use in mobile homes shall not be weatherized until the heating system has been replaced with a heating system designed for use in mobile homes.

2.0203.4a

Desired Outcome:

Sufficient air provided in the Combustion Appliance Zone (CAZ)

Specification(s):

The required volume of indoor air will be determined in accordance with Section G2407.5.1 or G2407.5.2 and authority having jurisdiction, except where the air infiltration rate is known to be less than 0.40 air changes per hour (ACH), at which time Section G2407.5.2 will be used

Objective(s):

Determine if existing conditions meet the combustion air calculation

2.0203.4b

Desired Outcome:

Sufficient air provided in the Combustion Appliance Zone (CAZ)

Specification(s):

Additional combustion air will be provided in accordance with 2012 IRC G2407 and authority having jurisdiction

Objective(s):

Ensure adequate combustion air for operation of the appliance

2.0203.4c

Desired Outcome:

Sufficient air provided in the Combustion Appliance Zone (CAZ)

Specification(s):

If a combustion appliance spillage exceeds 2 minutes during pressure testing, specify measures to mitigate

Objective(s):

Ensure appliance is not spilling longer than 2 minutes

2.0203.4d

Desired Outcome:

Sufficient air provided in the Combustion Appliance Zone (CAZ)

Specification(s):

All homes will have a functioning CO alarm

If CO levels in interior living spaces exceed outdoor levels, investigate potential sources and take appropriate action to reduce them (e.g., have a qualified professional tune, repair, or replace improperly operating combustion appliances; apply weatherstripping; or conduct air sealing between the garage or crawl space and the home)

Objective(s):

Ensure occupant health and safety

Ensure indoor CO levels do not exceed outdoor CO levels

2.0203.4e

Desired Outcome:

Sufficient air provided in the Combustion Appliance Zone (CAZ)

Specification(s):

Occupants will be educated on the operation and maintenance of the CO alarm

Completed work on combustion appliances and recommended maintenance will be reviewed with occupant

Occupant will be provided information regarding the health effects and risks of high CO concentrations

Objective(s):

Ensure occupant can operate and maintain installations

Inform occupant regarding possible CO hazards

2.0203.5a

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

If a combustion appliance spillage exceeds 2 minutes during pressure testing, specify measures to mitigate

Objective(s):

Ensure appliance is not spilling longer than 2 minutes

2.0203.5b

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

If a combustion appliance spillage exceeds 2 minutes during pressure testing, specify measures to mitigate

Objective(s):

Ensure appliance is not spilling longer than 2 minutes

2.0203.5c

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

The minimum required volume will be 50 cubic feet per 1,000 Btu/h in accordance with 2012 IRC G2407.5.1 or local authority having jurisdiction

Objective(s):

Determine if existing conditions meet the combustion air calculation

2.0203.5d

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

Additional combustion air will be provided in accordance with 2012 IRC G2407 or local authority having jurisdiction

Objective(s):

Ensure adequate combustion air for operation of the appliance

2.0203.5e

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

All homes will have a functioning CO alarm (EPA offers expanded actions)

If CO levels in interior living spaces exceed outdoor levels, investigate potential sources and take appropriate action to reduce them (e.g., have a qualified professional tune, repair, or replace improperly operating combustion appliances; apply weatherstripping; or conduct air sealing between the garage or crawl space and the home)

Objective(s):

Ensure occupant health and safety

Ensure indoor CO levels do not exceed outdoor CO levels

- All homes where combustible appliances are present and/or the home has an attached garage will have a functioning Carbon Monoxide Detector.

2.0203.5f

Desired Outcome:

Flue gasses successfully removed from the house

Specification(s):

Occupants will be educated on the operation and maintenance of the CO alarm

Completed work on combustion appliances and recommended maintenance will be reviewed with occupant

Occupant will be provided information regarding the health effects and risks of high CO concentrations

Objective(s):

Ensure occupant can operate and maintain installations

Inform occupant regarding possible CO hazards

2.0203.6a

Desired Outcome:

Buildup of flue gasses prevented with proper drafting

Specification(s):

The presence of an operable draft regulator will be verified

Combustion venting systems will be inspected for damage, leaks, disconnections, and other safety hazards

Objective(s):

Determine if a regulator is present and working and if vent system is in good condition and installed properly

2.0203.6b

Desired Outcome:

Buildup of flue gasses prevented with proper drafting

Specification(s):

A draft regulator will be installed if necessary

Manufacturer specifications for installation will be followed (e.g., size, type, location)

Objective(s):

Install regulator in accordance with manufacturer specifications

2.0203.6c

Desired Outcome:

Buildup of flue gasses prevented with proper drafting

Specification(s):

If a combustion appliance spillage exceeds 2 minutes during pressure testing, specify measures to mitigate

Objective(s):

Ensure appliance is not spilling longer than 2 minutes

2.0203.6d

Desired Outcome:

Buildup of flue gasses prevented with proper drafting

Specification(s):

All homes will have a functioning CO alarm; EPA offers expanded actions

If CO levels in interior living spaces exceed outdoor levels, potential sources will be investigated and appropriate action taken to reduce them (e.g., have a qualified professional tune, repair, or replace improperly operating combustion appliances; apply weatherstripping; conduct air sealing between the garage or crawl space and the home)

Objective(s):

Ensure occupant health and safety

Ensure indoor CO levels do not exceed outdoor CO levels

- All homes where combustible appliances are present and/or the home has an attached garage will have a functioning Carbon Monoxide Detector.

2.0203.6e

Desired Outcome:

Buildup of flue gasses prevented with proper drafting

Specification(s):

Occupants will be educated on the operation and maintenance of the CO alarm

Completed work on combustion appliances and recommended maintenance will be reviewed with occupant

Occupant will be provided information regarding the health effects and risks of high CO concentrations

Objective(s):

Ensure occupant can operate and maintain installations

Inform occupant regarding possible CO hazards

2.0204.1a

Desired Outcome:

Isolate combustion water heater closet from conditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Combustion safety
- Proper venting
- Structural integrity
- Roof leaks
- Insect infestation
- Accessibility
- Number, type, size, and location of penetrations

Objective(s):

Ensure combustion appliance is functioning safely

Ensure work space is safe and ready for air sealing

Verify scope of work

- Water heater compartment doors that are beyond repair shall be replaced. Appropriate photo documentation of the condition of the door shall be included in the client file.

2.0204.1b

Desired Outcome:

Isolate combustion water heater closet from conditioned space

Specification(s):

When the water heater closet contains a heater that is not sealed combustion or power vented, the closet will be isolated/separated from the rest of the home through air sealing with fire-rated materials, if feasible

Avoiding frozen pipes must be considered without creating an additional utility burden (e.g., heat tape)

Objective(s):

Prevent combustion gases from entering living area and minimize extension of interior pressures caused by exhaust fan, dryers, and interior door closure into the water heater closet

- All accessible water lines in the water heater compartment shall be insulated using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.

2.0204.1c

Desired Outcome:

Isolate combustion water heater closet from conditioned space

Specification(s):

Only noncombustible materials will be used in contact with chimneys, vents, and flues

Objective(s):

Prevent a fire hazard

- All openings from the water heater compartment into the conditioned space shall be sealed with metal or 5/8" fire code drywall.

2.0204.1d

Desired Outcome:

Isolate combustion water heater closet from conditioned space

Specification(s):

Blower door assisted zonal pressure diagnostics will be used to verify isolation has been achieved

Objective(s):

Prevent combustion gases from entering living area

2.0299.1a

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -2 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1b

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -3 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1c

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -5 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1d

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -5 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1e

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -7 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

- Mobile homes heated by naturally drafting combustion heating systems that are not specifically manufactured for use in mobile homes shall not be weatherized until the heating system has been replaced with a heating system designed for use in mobile homes.

2.0299.1f

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -15 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1g

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -15 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

- Mobile homes heated by naturally drafting combustion heating systems that are not specifically manufactured for use in mobile homes shall not be weatherized until the heating system has been replaced with a heating system designed for use in mobile homes.

2.0299.1h

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -15 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0299.1i

Desired Outcome:

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

Specification(s):

Manufacturer's certified negative pressure tolerance rating:

- Limit -25 pascals

Objective(s):

Ensure appliances meet manufacturer's certified negative pressure tolerance rating

2.0301.1a

Desired Outcome:

Properly installed smoke alarms

Specification(s):

Smoke alarms will be listed and labeled in accordance with UL 217 and installed (hardwired) in accordance with the 2012 IRC or as required by the authority having jurisdiction

Installation will be accomplished by a licensed electrician when required by the authority having jurisdiction

Objective(s):

Ensure proper installation

- The costs associated with the installation of smoke detectors are not allowed cost in the *Nebraska Weatherization Assistance Program*.

2.0301.1b

Desired Outcome:

Properly installed smoke alarms

Specification(s):

Battery-operated alarms will be installed in accordance with the 2012 IRC and manufacturer specifications

Objective(s):

Ensure proper installation

- The costs associated with the installation of smoke detectors is not allowed in the Nebraska Weatherization Assistance Program.

2.0301.2a

Desired Outcome:

Properly installed CO alarms or monitors

Specification(s):

Hardwired CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 or as required by the authority having jurisdiction

Installation will be accomplished by a licensed electrician when required by the authority having jurisdiction

Objective(s):

Ensure proper installation

- The costs associated with hardwiring CO alarms or monitors are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0301.2b

Desired Outcome:

Properly installed CO alarms or monitors

Specification(s):

Battery-operated CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 and manufacturer specifications as required by the authority having jurisdiction

Objective(s):

Ensure proper installation

- Installation of CO detectors is an allowable Health & Safety cost when detectors are not present or operable. Replacement of operable CO Detectors is not an allowable cost.

2.0401.1a

Desired Outcome:

Ensure durability of repairs and reduce potential for occupant exposure to mold and other moisture-related hazards

Specification(s):

Roof leaks will be repaired before performing attic air sealing or insulation

Moisture sources in the house that can generate moisture into the attic will be identified and removed or reduced

Water-resistant sealants and/or closed cell foams (use a minimum of 2" to reach water barrier requirement) will be used in all attic sealing details in cold climates

Plastic, foil, or any other Class 1 vapor barrier will not be used in hot humid climates

In marine climates, vapor permeable materials will be used to block and seal penetrations in attic

Objective(s):

Ensure durability of repairs

Reduce potential for occupant exposure to mold and other moisture-related hazards

Prevent moisture from communicating from within the conditioned space into unconditioned attic space when economically feasible

Increase durability of seal

Avoid moisture-related damage to the home

- The costs associated with roof leak repairs shall be encompassed in the homes overall \$500 incidental cost limit for the home.

2.0401.1b

Desired Outcome:

Ensure durability of repairs and reduce potential for occupant exposure to mold and other moisture-related hazards

Specification(s):

Exposed earth will be covered with a continuous, durable, sealed Class 1 vapor retarder a minimum of 6 mils in thickness

Plastic, foil, or any other Class 1 vapor barrier/retarder will not be used in hot-humid climates

All accessible penetrations between the crawl space or basement and outside will be sealed

Holes between the crawl space or basement and the living space will be sealed

Objective(s):

Ensure durability of repairs

Reduce potential for occupant exposure to mold and other moisture-related hazards

2.0401.1c

Desired Outcome:

Ensure durability of repairs and reduce potential for occupant exposure to mold and other moisture-related hazards

Specification(s):

Moisture sources in the home will be identified and removed or reduced

Local ventilation will be installed where appropriate (e.g., baths, kitchens) and vented to outside according to ASHRAE 62.2-2010

Unvented combustion appliances that are not listed to ANSI Z21.11.2 will be removed

Objective(s):

Ensure durability of repairs

Reduce potential for occupant exposure to mold and other moisture-related hazards

- Existing unvented clothes dryers shall be vented to the exterior and through the skirting.
- Kitchen and exhaust fans shall be vented to the exterior whenever possible.
- Exhaust vent pipe shall be fastened at all connections with sheet metal screws or rivets.
- Horizontal runs and elbows should be avoided.
- When vented to the exterior, the exhaust vent pipe shall be metal and the termination cap shall be dampered and attached with rust proof fasteners.

2.0401.1d

Desired Outcome:

Ensure durability of repairs and reduce potential for occupant exposure to mold and other moisture-related hazards

Specification(s):

Before air sealing basement or crawl space walls near wet areas, surface water pooling near the foundation will be addressed by:

- Repairing, modifying, or replacing gutters and downspouts
- Grading and subsurface drainage at critical locations (e.g., localized drain and grading beneath valleys) in accordance with EPA) Indoor airPLUS Construction Specifications Section 1.1
- Possible mitigation by waterproofing or installing draining plane with construction adhesive

Objective(s):

Reduce potential for occupant exposure to mold and other moisture-related hazards

- Costs associated with the installation of moisture precautions for exterior water are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

2.0403.4a

Desired Outcome:

Durable, effective ground moisture barrier that provides ongoing access and minimizes ground vapor

Specification(s):

If existing conditions of the ground and skirting mandates, a moisture barrier that covers the crawl space ground will be installed with allowances for structural supports (piers) and accessibility

Objective(s):

Reduce ground moisture entering crawl space

- A full ground laid moisture barrier shall be installed on mobile homes with relatively tight skirting or when insulated skirting is installed.
- A moisture barrier may be omitted in areas where run off is likely to collect. For homes that received insulated skirting, ground insulation shall not be installed in areas where the moisture barrier has been omitted.
- In the event the entire floor area cannot be covered, all accessible areas shall receive a moisture barrier.
- When installing insulated skirting without adequate clearance, the moisture barrier shall extend a minimum of 24 inches beyond the insulation and a minimum of 2 manual or thermostatic vents may be installed.

2.0403.4b

Desired Outcome:

Durable, effective ground moisture barrier that provides ongoing access and minimizes ground vapor

Specification(s):

A ground moisture barrier with a rating of no more than 0.1 perm will be used

A ground moisture barrier will be used that meets tear and puncture resistance standard ASTM E1745

Homeowner will be advised that all plastic is biodegradable and will have a life span much shorter than the home (5 years), and it will need replacing to remain effective

Objective(s):

Ensure crawl space is accessible for service and maintenance without damaging the integrity of the ground moisture barrier

2.0403.4c

Desired Outcome:

Durable, effective ground moisture barrier that provides ongoing access and minimizes ground vapor

Specification(s):

When seams exist, they will be overlapped a minimum of 12" using reverse or upslope lapping technique

Objective(s):

Keep water under the liner

Reduce likelihood of damage at seams

- The moisture barrier shall extend up the exterior walls and support columns at least 12".

2.0403.4d

Desired Outcome:

Durable, effective ground moisture barrier that provides ongoing access and minimizes ground vapor

Specification(s):

Ground moisture barrier may be fastened to ground with durable fasteners

Objective(s):

Prevent movement of the ground moisture barrier

2.0602.1a

Desired Outcome:

Prevention of static electric shock to the insulation installer when using rigid tubing

Specification(s):

Rigid fill tubes will be made of a material that will not hold an electric charge, such as Schedule 40 PVC Electrical Conduit, or be grounded

Objective(s):

Prevent injury to the installer

2.0602.1b

Desired Outcome:

Prevention of static electric shock to the insulation installer when using rigid tubing

Specification(s):

For an additional level of protection, the metal coupler on the hose will be connected to the grounding wire

Grounding wire will be connected to the grounding rod

Grounding rod will be driven into the ground a minimum of 8' when possible; grounding wire will be connected in compliance with local code and authority having jurisdiction

Objective(s):

Divert static discharge of electricity to ground instead of installer

2.0602.2a

Desired Outcome:

Prevention of injury to the installer and occupant, and prevent damage to the structure, if required by authority having jurisdiction

Specification(s):

Metal skin and frame will be grounded through the panel box to avoid electrical shock

Objective(s):

Prevent injury to the installer

2.0602.2b

Desired Outcome:

Prevention of injury to the installer and occupant, and prevent damage to the structure, if required by authority having jurisdiction

Specification(s):

For an additional level of protection, metal fill tube will be connected to the grounding wire

Grounding wire will be connected to the copper grounding rod that is driven into the ground a minimum of 8' when possible and required by code or authority having jurisdiction

Objective(s):

Divert house electric current to ground instead of installer in the event of contact with a live wire

2.0602.2c

Desired Outcome:

Prevention of injury to the installer and occupant, and prevent damage to the structure, if required by authority having jurisdiction

Specification(s):

An electrical safety assessment will be performed

All electric tools will be protected by ground-fault circuit interrupters (GFCI)

Three-wire type extension cords will be used with portable electric tools

Worn or frayed electric cords will not be used

Water sources (e.g., condensate pans) and electrical sources will be kept separate

Metal ladders will be avoided

Aluminum foil products will be kept away from live wires

For arc flash hazards, NFPA 70E will be consulted

Objective(s):

Avoid electrical shock and arc flash hazards

2.0602.2d

Desired Outcome:

Prevention of injury to the installer and occupant, and prevent damage to the structure, if required by authority having jurisdiction

Specification(s):

If aluminum wiring is present, work on the home will be stopped until the suspect wiring is inspected and determined to be safe by a licensed electrician

After energy retrofit is completed, wiring will be reinspected by a licensed electrician

Objective(s):

Prevent injury to installer and occupant

Prevent damage to structure

- Weatherization materials shall not be installed over or adjacent to outlets, switches or junction boxes that contain aluminum wiring.
- If the outlet or switch has aluminum wiring, insulators shall not be installed.

3.1001.4a

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Roof leaks
- Insect infestation
- Accessibility
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1001.4b

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the penetration or hole

The infill or backing will not bend, sag, or move once installed

All accessible damaged vapor barrier will be repaired

Penetration through the air barrier will be repaired

Objective(s):

Ensure closure is permanent and supports any load (e.g., wind, insulation, mechanical pressures)

Ensure sealant is effective and durable

All materials used to seal direct penetrations shall form a permanent and airtight seal.

3.1001.4c

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Sealants will be used to fill holes no larger than recommended by manufacturer specifications

Sealants will be compatible with all adjoining surfaces

Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction

Objective(s):

Create a permanent seal

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials

Create a continuous seal

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it shall be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the conditioned space shall be sealed with metal or 5/8" fire code gypsum.

3.1001.4d

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Ceiling repair material must meet or exceed strength of existing ceiling material

Ceiling repair must span from truss to truss or add blocking as needed for support

The backing or infill will not bend, sag, or move once installed

All accessible damaged vapor barriers will be repaired

Penetrations through the air barrier must be repaired

Objective(s):

Ensure ceiling is structurally sound

Minimize air leakage

Ensure closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant does not fall out

- The costs associated with ceiling repair shall not exceed the maximum incidental costs per home of \$500.

3.1001.4e

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it shall be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the conditioned space shall be sealed with metal or 5/8" fire code gypsum.

3.1001.4f

Desired Outcome:

Penetrations sealed to prevent air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Only noncombustible materials will be used in contact with chimneys, vents, and flues

Local codes will be referenced

Objective(s):

Prevent a fire hazard

- All openings from the water heater compartment into the conditioned space shall be sealed with metal or 5/8" fire code gypsum.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.

3.1101.1a

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Size of wall stud
- Insect infestation
- Accessibility
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

All materials to seal direct pevetrations shall form a permanent and airtight seal.

3.1101.1b

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Like material and/or compatible materials will be used for repairs

Materials will be selected to comply with manufactured housing rules and regulations (e.g., Manufactured Housing Institute)

Objective(s):

Select materials to ensure durable and permanent repair

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it shall be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the heated space shall be sealed with metal or 5/8" fire code drywall.

3.1101.1c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

All holes and penetrations on exterior surface of exterior walls will be sealed to ensure resistance to outdoor elements

Intentionally ventilated walls will not be sealed at vent locations (e.g., weep holes)

All holes and penetrations on the interior surface of exterior walls will be repaired

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected load

Ensure sealant is effective and durable

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it shall be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the heated space shall be sealed with metal or 5/8" fire code drywall.

3.1101.2a

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Size of wall stud
- Insect infestation
- Accessibility
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1101.2b

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

All accessible holes and penetrations in top and bottom plates will be sealed

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant is effective and durable

- A maximum of \$40 in material and labor per 100 cfm50 reduction in air leakage may be spent. The cfm50 reductions shall be checked at the end of each measure to determine its costeffectiveness.
- All materials used to seal direct penetrations shall form a permanent and airtight seal.

3.1101.2c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Like material and/or compatible materials will be used for repairs

Materials will be selected to comply with manufactured housing rules and regulations (e.g., Manufactured Housing Institute)

Objective(s):

Select materials to ensure durable and permanent repair

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- If mortar or mortar patch is used, it shall be a color complementary to the surface to which it is applied and be textured to match the surrounding surface as close as possible.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the heated space shall be sealed with metal or 5/8" fire code drywall.

3.1101.3a

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs to maintain structural integrity

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Insect infestation
- Accessibility
- Number, type, size, and location of penetrations
- Identify marriage walls and lines

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1101.3b

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs to maintain structural integrity

Specification(s):

All accessible holes and penetrations in top and bottom plates will be sealed

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant is effective and durable

3.1101.3c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs to maintain structural integrity

Specification(s):

All accessible holes and penetrations at marriage lines will be sealed continuously at end walls, floors, and ceiling

Backing or infill will be provided at the marriage line as needed

All remaining gaps will be sealed with an approved material

Objective(s):

Minimize air leakage

Maintain durability

Ensure sealant is effective and durable

- A maximum of \$40 in material and labor per 100 cfm50 reduction in air leakage may be spent. The cfm50 reductions shall be checked at the end of each measure to determine its cost effectiveness.

3.1101.3d

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs to maintain structural integrity

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

- Caulking shall be paintable and shall be clear or a color complementary to the surface to which it is applied.
- Caulking installed around heat-producing sources shall be specifically manufactured for installation around heat sources.
- Openings wider than ¼ inch shall be packed with material specifically designed as a packing material prior to caulking.
- Packing material shall be compatible with the type of caulking used.
- Expanding and non-expanding foam sealant may be used as an air sealing material.
- Spray applied insulation may be used as an air sealing material.
- All openings from the water heater compartment into the heated space shall be sealed with metal or 5/8" fire code drywall.

3.1201.5a

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Installer prework assessment will be conducted to determine:

- Number
- Type
- Operating condition
- Wall construction

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

- Exterior doors that are beyond repair shall be replaced.
- Door insect screens may be repaired or replaced.
- Weather strips, thresholds, door bottoms and sweeps shall be replaced as directed by blower door air sealing and infiltration reduction.
- Broken or missing storm door glass shall be repaired or replaced.
- Primary windows or window sashes that are beyond repair shall be replaced.
- Window insect screens may be repaired or replaced.
- Broken or missing window glass shall be repaired or replaced.

3.1201.5b

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise; documentation of testing results will be kept on file

EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

3.1201.5c

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

All egress windows will be operable as required by local codes

All egress doors will be operable as required by local codes

Objective(s):

Maintain operability of egress windows and doors

3.1201.5d

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Details that reduce air infiltration will be repaired, replaced, sealed, or installed (e.g., plastic gliders, weatherstripping, cranks, latches, locks, knobs, thresholds)

Objective(s):

Reduce air infiltration

- Weather-strips, thresholds, door bottoms and sweeps shall have a vinyl or silicone insert.
- Weather-strips and sweeps shall have the last fastener or screw no more than 2-1/2 inches from the end.
- Minor door adjustments such as tightening the hinges or adjusting the strike plate shall be completed.
- Replacement door glass shall not be less than "B" grade single strength.
- Door glass over 40 inches in either dimension shall not be less than "B" grade double strength.
- Door glass over 1 sq. ft. shall be safety glass.
- Door glass shall be secured with glazing points and glazing compound, if necessary and shall completely cover the channel.
- Damaged decorative door glass shall be replaced with a standard glass pane.
- If the client refuses a standard door glass pane, the door glass shall be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing door glass is a thermal pane or insulated glass and the interior or exterior pane is cracked, the cracked door glass shall be repaired.
- If the interior and/or exterior panes of door glass are broken, the door glass shall be replaced. Glass over 1 sq. ft. shall be replaced with safety glass and 1 sq. ft. or less shall be replaced with a standard glass pane.
- Replacement window glass shall not be less than "B" grade single strength.
- Window glass over 40 inches in either dimension shall not be less than "B" grade double strength.
- Window glass shall be secured with glazing points and glazing compound, if necessary and shall completely cover the channel.
- Damaged decorative window glass shall be replaced with a standard glass pane.
- If the client refuses a standard window glass pane, the window glass shall be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing window glass is a thermal pane or insulated glass and the interior or exterior pane is cracked, the cracked glass shall be repaired. If the interior and/or exterior panes of window glass are broken, the window glass shall be replaced with a standard glass pane.

3.1201.5e

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Details that reduce water infiltration will be repaired, replaced, or installed (e.g., replace missing glazing on sash, exterior caulking, exterior storm windows, storm doors, drip cap, J-channel, flashing)

Objective(s):

Reduce water infiltration

- Weather-strips, thresholds, door bottoms and sweeps shall have a vinyl or silicone insert.
- Weather-strips and sweeps shall have the last fastener or screw no more than 2-1/2 inches from the end.
- Minor door adjustments such as tightening the hinges or adjusting the strike plate shall be completed.
- Replacement door glass shall not be less than "B" grade single strength.
- Door glass over 40 inches in either dimension shall not be less than "B" grade double strength.
- Door glass over 1 sq. ft. shall be safety glass.
- Door glass shall be secured with glazing points and glazing compound, if necessary and shall completely cover the channel.
- Damaged decorative door glass shall be replaced with a standard glass pane.
- If the client refuses a standard door glass pane, the door glass shall be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing door glass is a thermal pane or insulated glass and the interior or exterior pane is cracked, the cracked door glass shall be repaired.
- If the interior and/or exterior panes of door glass are broken, the door glass shall be replaced. Glass over 1 sq. ft. shall be replaced with safety glass and 1 sq. ft. or less shall be replaced with a standard glass pane.
- Replacement window glass shall not be less than "B" grade single strength.
- Window glass over 40 inches in either dimension shall not be less than "B" grade double strength.
- Window glass shall be secured with glazing points and glazing compound, if necessary and shall completely cover the channel.
- Damaged decorative window glass shall be replaced with a standard glass pane.
- If the client refuses a standard window glass pane, the window glass shall be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing window glass is a thermal pane or insulated glass and the interior or exterior pane is cracked, the cracked glass shall be repaired. If the interior and/or exterior panes of window glass are broken, the window glass shall be replaced with a standard glass pane

3.1201.5f

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

3.1201.5g

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Windows and doors will be adjusted to properly fit the jamb and allow for ease of operation and security

Objective(s):

Ensure proper operation of the window, door, and hardware

Ensure air and watertight installation

3.1201.5h

Desired Outcome:

Windows and doors are operable, sealed, and weathertight

Specification(s):

Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain windows and doors

Objective(s):

Ensure long-term weathertightness

3.1201.6a

Desired Outcome:

Minimize air infiltration through existing leaky windows while maintaining safe egress for occupants

Specification(s):

Installer prework assessment will be conducted to determine:

- Number
- Type
- Size
- Condition of opening

Objective(s):

Verify scope of work

- Broken or missing storm door glass shall be repaired or replaced.
- One-light storms shall be fastened with clips, full-length magnetic strips or other means that completely seal the window and allow for easy attachment and/or removal.
- Self-storing storms shall be aluminum frame combination windows.
- If the primary window lacks a screen, the storm window shall be installed with a screen insert.
- Storms shall not be installed over fixed windows.

3.1201.6b

Desired Outcome:

Minimize air infiltration through existing leaky windows while maintaining safe egress for occupants

Specification(s):

Fixed interior storm windows will not be installed in egress locations

Objective(s):

Safety

3.1201.6c

Desired Outcome:

Minimize air infiltration through existing leaky windows while maintaining safe egress for occupants

Specification(s):

Operable interior storm windows will be installed in accordance with manufacturer specifications

Objective(s):

Minimize air leakage

Provide safe egress for occupants

3.1201.6d

Desired Outcome:

Minimize air infiltration through existing leaky windows while maintaining safe egress for occupants

Specification(s):

Interior storm windows will be operable and egress rated in egress locations

Objective(s):

Provide safe egress for occupants

3.1201.6e

Desired Outcome:

Minimize air infiltration through existing leaky windows while maintaining safe egress for occupants

Specification(s):

Occupants will be educated on the proper use and maintenance of storm windows

Objective(s):

Ensure weathertightness and safety

3.1202.3a

Desired Outcome:

Glass complete and intact

Specification(s):

Installer prework assessment will be conducted to determine:

- Number
- Type
- Location
- Operating condition
- Wall construction
- Size

Objective(s):

Ensure that work space is safe and ready for glass replacement

Verify scope of work

3.1202.3b

Desired Outcome:

Glass complete and intact

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise; documentation of testing results will be kept on file

EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

3.1202.3c

Desired Outcome:

Glass complete and intact

Specification(s):

Damaged glass will be removed

Objective(s):

Safely remove old glass

3.1202.3d

Desired Outcome:

Glass complete and intact

Specification(s):

Opening will be cleaned

Original sealant/material will be removed

Objective(s):

Prepare opening for new glass

3.1202.3e

Desired Outcome:

Glass complete and intact

Specification(s):

Replacement glass will be sized to original width, height, and depth

Stops will be replaced or installed

Glass will be sealed in accordance with original installation design

Glass will be selected with comparable tint and coating (color and look)

Tempered or safety glass will be used as required by local code

Objective(s):

Install, seal, and secure new glass in place

3.1203.3a

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Installer prework assessment will be conducted to determine:

- Number
- Type
- Operating condition
- Wall construction

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

- Replacement window glass shall not be less than "B" grade single strength.
- Window glass over 40 inches in either dimension shall not be less than "B" grade double strength.
- Damaged decorative window glass shall be replaced with a standard glass pane.
- If the client refuses a standard window glass pane, the window glass shall be repaired with clear silicone caulk or a material specifically designed to repair glass.
- If the existing window glass is a thermal pane or insulated glass and the interior or exterior pane is cracked, the cracked glass shall be repaired. If the interior and/or exterior panes of window glass are broken, the window glass shall be replaced with a standard glass pane.

3.1203.3b

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise; documentation of testing results will be kept on file

EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

3.1203.3c

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Window or door units will be designed for manufactured home use and will be ENERGY STAR qualified

Rough opening will be measured before ordering replacements

Access to emergency egress points, such as primary windows or exit doors, will be considered during the selection of retrofit window or door units

Objective(s):

Ensure proper size, type, and operation of window or door

3.1203.3d

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Existing units will be removed

Opening will be cleaned

Any damaged framing will be replaced

Opening for installation will be prepared in accordance with manufacturer specifications

Objective(s):

Provide a clean opening for replacement unit

3.1203.3e

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Window or door units will be installed in accordance with manufacturer specifications

Objective(s):

Ensure replacement window or door operates properly

Ensure replacement window or door has a weathertight fit

3.1203.3f

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Egress windows will only be replaced with egress windows

Objective(s):

Provide safe egress for occupants

3.1203.3g

Desired Outcome:

Smooth operation and an airtight and weathertight fit of replacement windows and doors

Specification(s):

Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain window or door

Objective(s):

Ensure long-term weathertightness

3.1301.1a

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Standing water
- Raw sewage
- Insect infestation
- Pests
- Accessibility
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1301.1b

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Patching material will be provided as needed to meet the specific characteristics of the bottom board material and the characteristics of the hole

Patch will have a service life of a minimum of 20 years

Objective(s):

Minimize air leakage

Keep insulation in place

Ensure repair materials are compatible

Ensure patch will support insulation

3.1301.1c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Patching will be provided as needed to meet both the specific characteristics of the bottom board material and the characteristics of the hole

Patch will not bend, sag, or move once installed

Patch will be permanent

Objective(s):

Minimize air leakage

Ensure repair materials are compatible

Minimize hole size to ensure successful use of sealant

Ensure closure is permanent and supports insulation

Ensure sealant does not fall out

3.1301.1d

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Combustion air supplies will be labeled for identification and will not be blocked or sealed

Penetrations will be sealed to meet both the specific characteristics of the bottom board material and the characteristics (hole size and type) of the penetrations (e.g., electrical, PVC, gas line, dryer vent)

The patch will not bend, sag, or move once installed

Objective(s):

Ensure combustion equipment is not compromised

Minimize air leakage around penetrations

3.1301.1e

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Materials will be selected to comply with manufactured housing rules and regulations (e.g., Manufactured Housing Institute)

Surface preparation and material selected will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

3.1301.2a

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Insect infestation
- Pests
- Accessibility
- Plumbing leaks
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1301.2b

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

The backing or infill will not bend, sag, or move once installed

Objective(s):

Ensure resulting closure is permanent and supports expected load

Ensure sealant is effective and durable

3.1301.2c

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Sealants will be used to fill holes no larger than recommended by manufacturer specifications

Sealants will be compatible with all adjoining surfaces

Sealants will be continuous and meet fire barrier specifications, if required

Objective(s):

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials

3.1301.2d

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Floor repair material will meet or exceed strength of existing floor material

Repair will span from joist to joist and blocking added as needed to support floor

Patches smaller than 144 square inches will not require repairs from joist to joist

Floor repair material will be glued, fastened, and air sealed

Objective(s):

Ensure floor is structurally sound

Minimize air leakage

3.1301.2e

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Materials will be selected to comply with manufactured housing rules and regulations (e.g., Manufactured Housing Institute)

Materials will be used or installed in accordance with manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

3.1301.2f

Desired Outcome:

Penetrations sealed to minimize air leakage and moisture movement between unconditioned and conditioned space; all repairs will maintain structural integrity

Specification(s):

Only noncombustible materials will be used in contact with chimneys, combustion exhaust vents, and flues

Objective(s):

Prevent a fire hazard

3.1302.1a

Desired Outcome:

Floor/framing around bay windows sealed and weathertight

Specification(s):

Installer prework assessment will be conducted to determine:

- Accessibility
- Number
- Type
- Size
- Operating condition
- Condition of opening
- Wall construction type

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1302.1b

Desired Outcome:

Floor/framing around bay windows sealed and weathertight

Specification(s):

Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise; documentation of testing results will be kept on file

EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

3.1302.1c

Desired Outcome:

Floor/framing around bay windows sealed and weathertight

Specification(s):

Details that reduce air infiltration will be repaired, replaced, sealed, or installed

Bay window floor framing that connects interior to exterior underpinning and insulation must be removed to seal gaps, cracks, and joints

Blocking must be installed on perimeter rail (rim joist) if missing

Seal all gaps, cracks, and joints of all framing in bay window assembly

Insulation must be replaced or installed in full contact with subfloor

Underpinning will be replaced and sealed

Objective(s):

Reduce air infiltration

3.1302.1d

Desired Outcome:

Floor/framing around bay windows sealed and weathertight

Specification(s):

Details that reduce water infiltration will be repaired, replaced, or installed

Objective(s):

Reduce water infiltration

3.1302.1e

Desired Outcome:

Floor/framing around bay windows sealed and weathertight

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Ensure proper use and installation of materials

3.1488.2a

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Installer prework assessment will be conducted to determine:

- Type (ventilated or unventilated, insulated or noninsulated)
- Extent of repair/replacement
- Accessibility
- Moisture and drainage
- Structural integrity of foundation (e.g., piers and supports)
- Structural integrity of perimeter rail/rim joist
- Integrity of existing skirting support material
- Presence of infestation or pests

Problems will be corrected before skirting work begins

Objective(s):

Ensure work space is safe and ready for repair or installation

Verify scope of work

3.1488.2b

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Manufacturer specifications will be followed when applicable

No exposed wood will be left unfinished (e.g., wood to be painted, sealed, treated)

If framing is required for skirting, framing will be structurally sound

Skirting will be installed to allow for movement (e.g., no screws or nails directly through panels)

Skirting installation will allow for expansion, contraction, and frost heaving

Objective(s):

Match existing skirting

Provide resistance from outdoor elements

Limit pest access

3.1488.2c

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Venting will be in accordance with local climate conditions or code as required

Objective(s):

Achieve and maintain building durability

3.1488.2d

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Insulated skirting may be installed where belly is inaccessible and not repairable

Objective(s):

Reduce conductive heat loss through floor assembly

3.1488.2e

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Flashing or proper caulking will be installed between skirting and manufactured home, if required by authority having jurisdiction

Objective(s):

Prevent water penetration

3.1488.2f

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Like material and/or compatible materials will be used for repairs (e.g., galvanized metal, aluminum, alkaline copper quaternary treated lumber)

Selected materials will be corrosion resistant

Objective(s):

Achieve/increase durability

3.1488.2g

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Like material and/or compatible materials will be used for repairs (e.g., galvanized metal, aluminum, alkaline copper quaternary treated lumber)

Fasteners will be corrosion resistant

Objective(s):

Achieve/increase durability

3.1488.2h

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Existing skirting support material will be structurally sound and completely intact; any damaged framing will be replaced

Objective(s):

Provide adequate support

3.1488.2i

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Skirting support (e.g., vinyl blowout rods, horizontal bracing for other types) will be placed in high-wind locations

Objective(s):

Increase strength to resist wind loading

3.1488.2j

Desired Outcome:

Wind, weather, debris, and pests are excluded from the underside of the home

Specification(s):

Occupants will be educated on maintenance of skirting (e.g., floating panels are not tightly screwed to framing, string trimmers may damage skirting)

Objective(s):

Increase durability

3.1601.2a

Desired Outcome:

Condition of ductwork identified and necessary repairs made in preparation for spray polyurethane foam (SPF) application

Specification(s):

All exposed ductwork in unconditioned spaces (e.g., attics, basements, crawl spaces) will be inspected

Broken joints or large cracks, gaps, or holes will be identified

Type of ductwork (e.g., metal, duct board, flex duct) will be identified

Type and R-value of existing duct insulation (e.g., fiberglass, stone wool, asbestos) will be identified as will the location of vapor retarders, if any

If asbestos insulation was used, it will not be disturbed; consult with an asbestos abatement expert for removal

Loose fitting or damaged fiberglass or stone wool insulation will be removed using proper safety equipment

Necessary clearances for installation of SPF will be ensured

Objective(s):

Identify damaged ductwork in need of repair

Identify type and R-value of existing insulation

3.1601.2b

Desired Outcome:

Condition of ductwork identified and necessary repairs made in preparation for spray polyurethane foam (SPF) application

Specification(s):

Broken or missing ductwork will be repaired or replaced

All cracks, gaps, or holes greater than ¼" will be taped or sealed as feasible

Dust, dirt, and grease will be removed from exterior surfaces of ducts

Objective(s):

Cover openings in ducts to prevent SPF from entering the interior of the duct

Ensure surfaces of duct are clean to promote proper adhesion of SPF

3.1601.4a

Desired Outcome:

Ducts and plenums properly supported

Specification(s):

Flexible and duct board ducts and plenums will be supported where feasible in accordance with flex duct manufacturer specifications and local codes

Support materials will be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified (e.g., ceiling, framing, strapping)

Metal ducts will be supported by metal strapping, rods, or other materials, where feasible

Objective(s):

Eliminate falling and sagging

3.1601.5a

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Surrounding insulation will be cleared to expose joints being sealed; salvage for reuse if possible

Duct surface to receive sealant will be cleaned

Objective(s):

Gain access while maintaining insulation value

Achieve proper adhesion for airtight seal when needed to ensure a tight fit to the framing structure and ensure the register can be removed and reinstalled by the dwelling occupant

3.1601.5b

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Ducts will be fastened with a minimum of three equally spaced screws

Objective(s):

Ensure durable joints

3.1601.5c

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Joints will be fastened with tie bands using a tie band tensioning tool

For oval flexible duct to metal connections, tie bands cannot be used; appropriate mechanical fastener will be used

All connections, regardless of fastener, will be sealed

Objective(s):

Ensure durable joints

3.1601.5d

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Joints will be fastened with outward clinching (stitch) staples and c-channels if possible

Objective(s):

Ensure durable joints

3.1601.5e

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Metal take-off collar specifically designed for the thickness of the duct board will be used

All finger tabs will be bent down securely

Finger tabs will be longer than the thickness of the duct board and the shank will not extend beyond the thickness of the duct board

There will be an internal metal backer inside the duct board through which three evenly spaced screws can be secured; the metal backer will not interfere with air flow

Objective(s):

Ensure durable joints

Prevent the collar from moving into or out of the duct board or slipping

3.1601.5f

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Flange/c-channel will be fastened with screws with the duct board installed between c-channel flanges

Duct board plenum will be connected to air handler plenum with flexible duct in upflow units

Objective(s):

Ensure durable joints

3.1601.5g

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Predrill for screws or use ring shanked nails to fasten boot to wood

Objective(s):

Ensure durable joints

3.1601.5h

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

If accessible, boot hanger will be fastened to adjacent framing with screws or nails

Boot will be connected to boot hanger with screws

If inaccessible, boot will be fastened to gypsum with a durable, adhesive sealant

Objective(s):

Ensure durable joints

3.1601.5i

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

Specification(s):

Metal take-off collar with a hip and an internal metal backer will be used

Take-offs will be in accordance code requirements

Objective(s):

Ensure durable joints

3.1602.2a

Desired Outcome:

Exposed ductwork in unconditioned spaces insulated and sealed

Specification(s):

Insulation will be installed according to manufacturer specifications and all provisions of the 2012 IRC

SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer

Sufficient insulation will be applied to all joints and around all penetrations to the conditioned space through walls, floors, and ceilings

SPF will be covered with proper fire protective coverings or coatings appropriate for location of ductwork and type of foam used, and provisions of the 2012 IRC and local codes

If ducts are used for air-conditioning, an appropriate vapor retarder will be applied on the SPF if open-cell SPF used

If 2" or more of closed-cell SPF is used, follow manufacturer specification to determine if additional vapor retarder is needed

The flame spread index will not be greater than 25 and the smoke- developed index will not be greater than 450 at the specified installed thickness

The foam plastic will be protected with an ignition barrier

Objective(s):

Insulate and seal all exposed ductwork in unconditioned spaces

Manage moisture condensation on ductwork that carries cooled air in warm, moist climates

Provide adequate fire protection for exposed SPF

3.1602.8a

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Installer prework assessment will be conducted to determine:

- Size of plenum
- Alignment
- Connection method
- Existing sealing

Objective(s):

Ensure an efficient and effective way to accomplish work

Verify scope of work

3.1602.8b

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Debris will be removed

Surface will be prepared for work (e.g., remove tape, oil)

Floor will be prepared to receive the appropriately sized plenum

Objective(s):

Provide unobstructed path for work access and air flow

Ensure adhesion of materials to be installed

Provide a properly sized plenum to maximize distribution of air flow (equal to the furnace discharge)

3.1602.8c

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Plenum will be rebuilt or repaired using compatible materials and will be:

- Mechanically fastened
- Sealed
- Durable
- Structurally sound
- Insulated
- Equipped with a vapor retarder where climate appropriate

If possible, flow diverter or turning vanes will be installed for air flow and/or balancing (e.g., bullhead Ts, offset air handler)

Objective(s):

Minimize restrictions

Maximize air flow and air distribution

Minimize moisture issues

Prevent condensation on plenum

3.1602.8d

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Point of access options include:

Option 1: Through the trunk duct

- Repair and seal access hole in the trunk duct
- Install insulation
- Repair belly/bottom liner

Option 2: Remove crossover duct

- Reattach crossover duct
- Seal and insulate crossover duct
- Repair belly/bottom liner

Option 3: Remove air handler

- Install new gasket, if necessary
- Mechanically attach furnace to the structure
- Reconnect utilities
- Replace and seal panels

Option 4: Through the furnace panel

- Replace and seal panels

Objective(s):

Repair work access

Prevent condensation

Minimize heat loss and heat gain from plenum

3.1602.8e

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Equipment will be cycled

Combustion Appliance Zone (CAZ) test will be performed where combustion appliances are utilized

Objective(s):

Verify operation

Identify unsafe equipment operating conditions

3.1602.8f

Desired Outcome:

Deliver all air from air handler to the trunk duct without leakage or restriction

Specification(s):

Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program

Objective(s):

Document post-retrofit duct leakage test has been performed

3.1602.9a

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Installer prework assessment will be conducted to determine:

- Location
- Types
- Leakage points

Objective(s):

Verify scope of work

3.1602.9b

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Flexible crossover duct connections will be added, rebuilt, or repaired using compatible materials and will be:

- Mechanically fastened at both inner and outer liner
- Sealed using UL-listed sealant that is durable, structurally sound, insulated
- Equipped with a vapor retarder

Whenever possible, rigid elbow or equivalent will be installed in crawl space crossover ducts

Floor insulation will be in contact with the outer liner of the crossover duct

Crossover duct vapor retarder will be sealed to the bottom liner (e.g., belly fabric)

New flex duct installation will be insulated to a minimum of R-8

When feasible, 26-gauge hard duct should be installed

If a new crossover is required, it must be insulated to at least R-8 and be air sealed

Objective(s):

Ensure lasting durable connections

Minimize air leakage and heat transfer

Maintain duct diameter around the turns

Maximize air flow and distribution

3.1602.9c

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Crossover ducts will be installed so they are not in contact with the ground

Crossover ducts will be supported in accordance with flex duct manufacturer specifications, local codes

Support materials will be applied in accordance with manufacturer specifications for interior dimensions and will not crimp ductwork, dip, or sag

Objective(s):

Maximize air flow and distribution

Minimize condensation

Minimize air leakage and heat transfer

3.1602.9d

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Through-the-rim crossover ducts will be located and accessed through the bottom liner and branch duct; all branch crossover duct connections and end caps will be located and accessed

Hole size (air pathway) will be maximized between branch crossover and trunk

All connections will be mechanically fastened and sealed inside duct

End caps will be sealed

Objective(s):

Ensure all connections are identified

Maximize air flow and distribution

Ensure lasting durable connections

Minimize air leakage

3.1602.9e

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Access hole in the trunk duct will be repaired and sealed

Insulation will be reinstalled

Bottom liner/belly will be repaired

Objective(s):

Repair work access

Minimize heat transfer

3.1602.9f

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Access to the attic will be created for all attic areas that contain crossover ducts, where feasible

Plenum boxes and crossover duct connections will be rebuilt, mechanically fastened, and sealed

Access holes will be repaired

Objective(s):

Ensure lasting durable connections

Minimize air leakage

Maximize air flow and distribution

Repair work access

3.1602.9g

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

CAZ testing will be performed where combustion appliances are utilized

Objective(s):

Identify unsafe equipment operating conditions

3.1602.9h

Desired Outcome:

Deliver all air from trunk to trunk without leakage or restriction

Specification(s):

Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program

Objective(s):

Document post-retrofit duct leakage test has been performed

3.1602.10a

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

Installer prework assessment will be conducted to determine:

- Location
- Connection types
- Leakage points

Access holes will be created for the work done at each location

Objective(s):

Verify scope of work

Gain access to duct connections

3.1602.10b

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

Excess flex duct will be removed between the takeoff at trunk and floor register boot

Objective(s):

Improve air flow

3.1602.10c

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

Hard and flex duct branch connections will be rebuilt or repaired using compatible materials and will be mechanically fastened and sealed

Ends will be sealed

Objective(s):

Ensure lasting durable connections

Minimize air leakage

Maximize air flow and distribution

3.1602.10d

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

Access hole in the trunk/branch duct will be repaired and sealed

Insulation will be reinstalled

Bottom liner/belly will be repaired

Objective(s):

Repair work access

Minimize heat transfer

3.1602.10e

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

CAZ testing will be performed where combustion appliances are utilized

Objective(s):

Identify unsafe equipment operating conditions

3.1602.10f

Desired Outcome:

Deliver air from trunk to termination (register/diffuser) without leakage

Specification(s):

Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program

Objective(s):

Document post-retrofit duct leakage test has been performed

3.1602.11a

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Any closure system used will meet or exceed applicable standards

Objective(s):

Ensure effectiveness of air sealing system

3.1602.11b

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Duct surface to receive sealant will be cleaned

Seams, cracks, joints, holes, and penetrations less than ¼" will be sealed using fiberglass mesh and mastic

Mastic alone will be acceptable for holes less than ¼" that are more than 10' from air handler

Holes greater than ¾" will be patched with metal or joint will be rebuilt to reduce the gap size

Seams, cracks, joints, holes, and penetrations between ¼" and ¾" will be sealed in two stages:

- They will be backed using temporary tape (e.g., foil tape) as a support before sealing
- They will be sealed using fiberglass mesh and mastic

Objective(s):

Eliminate air leakage into or out of ducts and plenums

Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct

Reinforce seal

Support mastic and fiberglass mesh during curing

3.1602.11c

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Duct surface to receive sealant will be cleaned

Fiberglass mesh and mastic will overlap temporary tape by at least 1" on all sides

Seams, cracks, joints, holes, and penetrations larger than $\frac{3}{4}$ " will be repaired using rigid duct material

Fiberglass mesh and mastic will overlap repair joint by at least 1" on all sides

Fiberglass mesh and mastic will be the primary seal

Objective(s):

Eliminate air leakage into or out of ducts and plenums

Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct

Reinforce seal

Support mastic and fiberglass mesh during curing

3.1602.11d

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program

Objective(s):

Document post-retrofit duct leakage performed

3.1602.12a

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Gaps between boot and gypsum less than a ¼" will be sealed using mastic or appropriate flexible caulking

Gypsum edge will be wetted before applying mastic

Objective(s):

Prevent air leakage

3.1602.12b

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Joints will be sealed and cracks/holes not needed for proper function of unit will be sealed using removable sealant (e.g., foil tape)

Objective(s):

Reduce air leakage while maintaining accessibility

3.1602.12c

Desired Outcome:

Ducts and plenums sealed to prevent leakage

Specification(s):

Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program

Objective(s):

Document post-retrofit duct leakage test has been performed

3.1701.1a

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Structural integrity
- Roof leaks
- Insect infestation
- Accessibility
- Mechanical attachment
- Location of marriage wall seams
- Number, type, size, and location of penetrations

Objective(s):

Ensure work space is safe and ready for air sealing

Verify scope of work

3.1701.1b

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Marriage wall seams will be sealed continuously at walls, floors, and ceiling connection

All accessible holes and penetrations in the addition envelope will be sealed

Backing or infill will be provided as needed, when accessible

Objective(s):

Minimize air leakage

Maintain durability and/or flexibility

Ensure sealant is effective and durable

3.1701.1c

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

3.1701.1d

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

All holes and penetrations on exterior surface of exterior walls will be sealed to ensure resistance to outdoor elements

Intentionally ventilated walls will not be sealed at vent locations (e.g., weep holes)

All holes and penetrations on the interior surface of exterior walls will be repaired

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant is effective and durable

3.1701.1e

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

All accessible holes and penetrations in top and bottom plates will be sealed

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

Objective(s):

Minimize air leakage

Maintain durability

Ensure resulting closure is permanent and supports expected load

Ensure sealant is effective and durable

3.1701.1f

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration

The backing or infill will not bend, sag, or move once installed

Objective(s):

Ensure resulting closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant is effective and durable

3.1701.1g

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Sealants will be used to fill holes no larger than recommended by manufacturer specifications

Sealants will be compatible with all adjoining surfaces

Sealants will be continuous and meet fire barrier specifications, if required

Objective(s):

Create a permanent seal

Ensure sealant meets or exceeds the performance characteristics of the surrounding materials

3.1701.1h

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Floor repair material will meet or exceed strength of existing floor material

Repair will span from joist to joist and blocking added as needed to support floor

Patches smaller than 144 square inches will not require repairs from joist to joist

Floor repair material will be glued, fastened, and air sealed

Objective(s):

Ensure floor is structurally sound

Minimize air leakage

3.1701.1i

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Materials will be used or installed in accordance with product manufacturer specifications

Objective(s):

Select materials to ensure durable and permanent repair

3.1701.1j

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Ceiling repair material must meet or exceed strength of existing ceiling material

Ceiling repair must span from truss to truss or add blocking as needed for support

The backing or infill will not bend, sag, or move once installed

All accessible damaged vapor barriers will be repaired

Penetrations through the air barrier must be repaired

Objective(s):

Ensure ceiling is structurally sound

Minimize air leakage

Ensure closure is permanent and supports expected wind and mechanical pressure loads

Ensure sealant does not fall out

3.1701.1k

Desired Outcome:

The exterior of the seam is weathertight and connection between house and addition is properly sealed to minimize air leakage and moisture movement between unconditioned and conditioned space

Specification(s):

Only noncombustible materials will be used in contact with chimneys, vents, and flues

Objective(s):

Prevent a fire hazard

4.1003.8a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

All combustion appliance flues will be terminated to the outdoors and terminations will maintain proper clearance above snow loads

A distance no less than 2" will be maintained between any combustion appliance flue and combustible materials, unless zero clearance flue is in place

All ventilation systems will maintain a continuous connection and terminate to the outdoors

All broken mushroom vents will be replaced or removed and sealed

All plumbing stacks will be terminated to the outdoors

Non-IC rated light fixtures will be replaced with airtight IC-rated fixtures

All recessed lights will be labeled as having an air leakage rate no more than 2.0 CFM when tested in accordance with ASTM E 283 at a 75 pascals pressure differential

All obvious ceiling penetrations will be sealed

The space between combustion appliance flues and the ceiling will be sealed with fire-rated materials

All roof, attic, and ceiling assemblies will be structurally sound; loose ceiling panels will be secured

Temporary ceiling bracing will be recommended during the insulation installation process

Dishing and pooling issues that allow standing water will be addressed

All known roof water leaks will be repaired before insulation installation

Objective(s):

Ensure occupant and worker safety

Verify attic space is ready to insulate

Ensure structural integrity of the roof and ceiling assembly

Prevent intrusion of bulk moisture

Prevent damage during the insulation installation process

4.1003.8b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Fasteners will be removed from the J channel and the roof edge on the most easily accessible side of the house

Roof will be separated from the heel plate and siding roof will be lifted and propped to accommodate fill tube

Length of opening will be enough to allow ease of access and reattachment while minimizing potential damage from high winds

If subsheathing is present, access will be gained through subsheathing

Attic will be visually inspected for the location of existing insulation, obstructions, hazards, and construction type

Objective(s):

Create access to the full attic cavity

Protect roof from wind damage during installation

Ensure ease of roof reattachment

Determine insulation installation technique

4.1003.8c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Hose outlet pressure will be set in accordance with manufacturer specifications

Objective(s):

Ensure machine is capable of delivering uniform insulation density and coverage

4.1003.8d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Insulation will be installed to a density of 1.5 to 1.6 pounds per cubic foot

Using fill tube, 100% of each cavity will be filled to a consistent density

Fill tube will be inserted within 6" of the end of each attic cavity

Insulation will be installed into the void of the attic cavity:

- If existing insulation is roof-mounted, insulation will be blown below
- If existing insulation is ceiling-mounted, insulation will be blown above
- If existing insulation is mounted at both locations, insulation will be blown in between

Avoid overfilling of roof edges and above attic trusses

Flame spread and smoke-developed index for insulation will be a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84

Objective(s):

Fill entire attic cavity to the prescribed R-value to reduce air infiltration

Avoid clogging of the cavity and the fill tube

Prevent damage to the ceiling

Allow roof to be returned to original position

Fire safety will be maintained

4.1003.8e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If existing J channel is damaged, it will be replaced

Existing sealant will be removed from the roof edge and J channel

At a minimum, new sealant will be reinstalled at the original location

Roof and J channel will be fastened to the original location with new screws

All seams, edges, and penetrations will be sealed as necessary

Objective(s):

Prepare roof edge and J channel for reattachment

Reattach roof edge and J channel without leaks

4.1003.8f

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installation process will be considered complete when installer has verified that damage has not occurred to the roof or ceiling assemblies during the installation process

Objective(s):

Verify the integrity of the house has been maintained

4.1003.8g

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:• Insulation type• Coverage area• R-value• Installed thickness and minimum settled thickness • Number of bags installed in accordance with manufacturer specifications

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area completed

Comply with 16 CFR 460.17

4.1003.9a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

All combustion appliance flues will be terminated to the outdoors and terminations will maintain proper clearance above snow loads

A distance no less than 2" will be maintained between any combustion appliance flue and combustible materials, unless zero clearance flue is in place

All ventilation systems will maintain a continuous connection and terminate to the outdoors

All broken mushroom vents will be replaced or removed and sealed

All plumbing stacks will be terminated to the outdoors

Non-IC rated light fixtures will be replaced with airtight IC-rated fixtures

All recessed lights will be labeled as having an air leakage rate not more than 2.0 CFM when tested in accordance with ASTM E 283 at a 75 pascals pressure differential

All obvious ceiling penetrations will be sealed

The space between combustion appliance flues and the ceiling will be sealed with fire-rated materials

All roof, attic, and ceiling assemblies will be structurally sound:

- Loose ceiling panels will be secured
- Temporary ceiling bracing will be recommended during the insulation installation process

Dishing and pooling issues that allow standing water will be addressed

All known roof water leaks will be repaired before installing installation

Objective(s):

Ensure occupant and worker safety

Verify attic space is ready to insulate

Ensure structural integrity of the roof and ceiling assembly

Prevent intrusion of bulk moisture

Prevent damage while installing insulation

4.1003.9b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Access to the attic cavity will be created using one of these methods:

- Drilling
- Cutting
- Continuous slicing along the center line (at the highest point of the roof)

Access location will be placed to allow for consistent and uniform coverage of installed insulation throughout the attic assembly

There will be, at a minimum, one opening between each roof truss

Openings will be large enough to accommodate the chosen fill tube

If subsheathing is present, access will be gained through subsheathing

Attic will be visually inspected for the location of existing insulation, wiring, flues, obstructions, hazards, and construction type

Objective(s):

Create access to the full attic cavity

Maintain the integrity of the roof truss

Protect roof from wind damage during installation

Determine technique for installing insulation

4.1003.9c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Hose outlet pressure will be set in accordance with manufacturer specifications

Objective(s):

Ensure machine is capable of delivering uniform insulation density and coverage

4.1003.9d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Insulation will be installed to a density of 1.5 to 1.6 pounds per cubic foot

Using fill tube, 100% of each cavity will be filled to a consistent density

Fill tube will be inserted within 6" of the end of each attic cavity

Insulation will be installed into the void of the attic cavity:

- If existing insulation is roof-mounted, insulation will be blown below
- If existing insulation is ceiling-mounted, insulation will be blown above
- If existing insulation is mounted at both locations, insulation will be blown in between

Insulation will be filled no higher than the top of the truss

Flame spread and smoke-developed index for insulation will be a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84

Objective(s):

Fill entire attic cavity to the prescribed R-value to reduce air infiltration

Avoid clogging of the cavity and the fill tube

Prevent damage to the ceiling

Allow roof to be returned to original position

Fire safety will be maintained

4.1003.9e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If the roof is sliced:

- A solid metal ridge cap will be centered over the slice
- A flexible and durable sealant will be sandwiched between the roof and the ridge cap
- Screws will be installed to prevent wrinkles and create a permanent seal
- Screws will not go into any wood framing
- A durable and flexible final coating will be applied over the screws and edge of the ridge cap to create a continuous seal between the roof and the perimeter of the ridge cap

For holes that are drilled or cut, the initial patch will be applied using the following procedure:

- At least 6" of surface surrounding the opening will be cleaned before patch is installed
- Sealant will be continuous and applied in between the patch and the roof
- Sealant will be an all-weather adhesive that is flexible and durable

If a metal patch is used:

- Patch will overlap the opening by 2" on all sides
- Gauge will be equal to or greater than the roof material
- Fasteners will be installed to prevent wrinkles and create a permanent seal
- If a plug is used, it will be flanged and have a tight fit
- Screws will not go into any wood framing

A durable and flexible 45 mil adhesive patch will be applied in accordance to manufacturer specifications over the initial patch and will have at a minimum:

- Tear strength of 640g
- Elongation of 380%
- Application temperature no lower than 55°F and no greater than 110°F
- Services temperature no less than -25°F and no greater than 150°F
- Adhesive patch will overlap the initial patch by 2" on all sides
- A durable and flexible final coating will be applied over the adhesive patch to create a continuous seal between the roof and the perimeter of the patch
- All remaining seams, edges, and penetrations will be sealed as necessary

Objective(s):

Effectively patch and seal all openings

Create a durable patch that will prevent roof leaks

4.1003.9f

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installation process will be considered complete when installer has verified that damage has not occurred to the roof or ceiling assemblies during the installation process

Objective(s):

Verify the integrity of the house has been maintained

4.1003.9g

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
- Installed thickness and minimum settled thickness
- Number of bags installed in accordance with manufacturer specifications

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area complete

Comply with 16 CFR 460.17

4.1003.10a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

All combustion appliance flues will be terminated to the exterior of the house and terminations will maintain proper clearance above snow loads

A distance no less than 2" will be maintained between any combustion appliance flue and combustible materials, unless zero clearance flue is in place

All ventilation systems will maintain a continuous connection and terminate to the outdoors

All broken mushroom vents will be replaced or removed and sealed

All plumbing stacks will be terminated to the outdoors

Non-IC rated light fixtures will be replaced with airtight IC-rated fixtures, if feasible and only when installed measures will compromise the fire rating of the fixture

All recessed lights will be labeled as having an air leakage rate no more than 2.0 CFM when tested in accordance with ASTM E 283 at a 75 pascals pressure differential

All obvious ceiling penetrations will be sealed

The space between combustion appliance flues and the ceiling will be sealed with fire-rated materials

All roof, attic, and ceiling assemblies will be structurally sound:

- Loose ceiling panels will be secured
- Temporary ceiling bracing will be recommended while installing installation

Dishing and pooling issues that allow standing water will be addressed

All known roof water leaks will be repaired before installing installation

Objective(s):

Ensure occupant and worker safety

Verify attic space is ready to insulate

Ensure structural integrity of the roof and ceiling assembly

Prevent intrusion of bulk moisture

Prevent damage while installing insulation

4.1003.10b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Special precautions will be taken to limit fiberglass and construction dust exposure to the occupant and occupant belongings

Objective(s):

Protect occupant health and safety

Protect occupant belongings

4.1003.10c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Equidistant holes will be drilled in a straight row parallel to the longitudinal exterior wall of the ceiling

If a longitudinal ceiling trim piece exists, trim piece will be removed and holes will be drilled behind the trim

Hole location and size will be placed to provide access to allow for consistent and uniform coverage of installed insulation throughout the attic assembly

There will be, at a minimum, one hole between each roof truss

Holes will be large enough to accommodate the chosen fill tube without damaging the ceiling material during installation

If a vapor barrier or ceiling-mounted insulation is present, access will be gained through them

Attic will be visually inspected for the location of existing insulation, obstructions, hazards, and construction type

Objective(s):

Create access to the full attic cavity

Determine insulation installation technique

Prevent damage to ceiling

Create a professionally finished ceiling

4.1003.10d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Hose outlet pressure will be set in accordance with manufacturer specifications

Objective(s):

Ensure machine is capable of delivering uniform insulation density and coverage

4.1003.10e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Insulation will be installed to a density of 1.5 to 1.6 pounds per cubic foot

Using fill tube, 100% of each cavity will be filled to a consistent density

Fill tube will be inserted within 6" of the end of each attic cavity

Insulation will be installed into the void of the attic cavity:

- If existing insulation is roof-mounted, insulation will be blown below
- If existing insulation is ceiling-mounted, insulation will be blown above
- If existing insulation is mounted at both locations, insulation will be blown in between

Flame spread and smoke-developed index for insulation will be a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84

Objective(s):

Fill entire attic cavity to the prescribed R-value to reduce air infiltration

Avoid clogging of the cavity and the fill tube

Prevent damage to the ceiling

Fire safety will be maintained

4.1003.10f

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Holes will be plugged or covered and sealed to be aesthetically pleasing

If existing trim was removed, it will be reinstalled

Objective(s):

Create an airtight seal

Create a visually acceptable ceiling finish

4.1003.10g

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installation process will be considered complete when installer has verified that damage has not occurred to the roof or ceiling assemblies during the installation process

Objective(s):

Verify the integrity of the house has been maintained

4.1003.10h

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
- Installed thickness and minimum settled thickness
- Number of bags installed in accordance with manufacturer specifications

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area completed

Comply with 16 CFR 460.17

4.1003.11a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If occupant will allow access from interior, installation through the ceiling is preferred

Attic space created by the roof-over will be accessed in accordance with the Single-Family Attic Access SWS

If the roof-over does not allow physical access to the roof-over attic, access to the original attic will be gained through roof venting

If existing insulation height in the attic is less than the height of the heel plate (original attic), access will be made through the original roof and the original attic cavities will be filled before blowing insulation over the original roof

At a minimum, the access holes to the original attic cavities will be sealed to prevent air leakage

If existing insulation height is equal to or greater than the height of the heel plate (original attic), the insulation will be installed in the end cavities before blowing on top of the original roof

Access to the end cavities will be gained and insulation will be installed

At a minimum, the access holes to the original attic cavities will be sealed to prevent air leakage

Insulation will not be installed on top of the original roof until the end cavities are insulated and air sealed in original attic

If insulation is installed on top of the original roof, it will be installed in accordance with the Single-Family SWS Loose Fill Blown Fiberglass Insulation Installation

Objective(s):

Gain access to the combined attic spaces

Address thermal bridging

Correctly insulate the combined attic spaces

4.1003.11b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
- Installed thickness and minimum settled thickness
- Number of bags installed in accordance with manufacturer specifications

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area completed

Comply with 16 CFR 460.17

4.1088.6a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A visual inspection of the highest point of the transition wall will be completed

Access points will be determined from the gable end, roof, ceiling, or interior paneling

Objective(s):

Verify the height and the accessibility of the attic

4.1088.6b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Attic will be accessed through the location that allows the most efficient and effective insulation coverage

Objective(s):

Gain access to the flat and cathedral ceiling transition wall

4.1088.6c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Insulation will be blown against the transition wall until the wall is covered

Objective(s):

Ensure machine is capable of delivering uniform insulation density and coverage to meet manufacturer specifications for loose blown insulation

Create a thermal barrier at the transition wall

4.1088.6d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Insulation will be installed to prescribed R-value in accordance with manufacturer specifications

Spray polyurethane foam (SPF) will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer

Objective(s):

Insulate and seal transition wall

4.1088.6e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Batt insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions

Insulation will be installed to the prescribed R-value

Vapor barrier will be installed based on regional considerations

Objective(s):

Insulate to prescribed R-value

4.1088.6f

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Created access points will be covered and sealed in an aesthetically pleasing manner

Existing access points (e.g., gable vent) will be returned to the original condition

If existing trim was removed, it will be reinstalled

Objective(s):

Create an airtight seal

Create an aesthetically pleasing finish

4.1088.6g

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installation process will be considered complete when installer has verified that damage has not occurred to the roof or ceiling assemblies during the installation process

Objective(s):

Verify the integrity of the house has been maintained

4.1088.6h

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
 - Installed thickness and settled thickness (settled thickness required for loose-fill only) •
 - Number of bags installed in accordance with manufacturer specifications (for loose-fill only)

Objective(s):

Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17

4.1101.5a

Desired Outcome:

Walls properly prepared to receive dense pack insulation

Specification(s):

Lead safety procedures will be followed

Cavities will be free of hazards, intact, and able to support dense pack pressures

Drilling hazards (e.g., wiring, venting, fuel piping) will be located

Blocking will be installed around:

- All openings to inside of the crawl space and basement for fibrous material
- High temperature fire-rated materials
- Wiring and electrical hazards
- Heat sources

Access to exterior wall cavities will be gained, sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers

When accessing wall cavities, the interior will be masked to control dust during drilling

Electricity supply will be confirmed and will support blowing machine power demand

Blowing machine pressure test will be performed with air on highest level, feed off, and gate closed

Hose outlet pressure will be at least 80 IWC or 2.9 psi for cellulose insulation; for other types of dense pack insulation, check manufacturer specification for blowing machine set up

Objective(s):

Prevent damage to the house

Provide a clean work space

Provide thorough access to allow 100% coverage

Ensure proper equipment and process results in consistent density

Prevent settling and retard air flow through cavities

Protect worker and occupant health

4.1101.5b

Desired Outcome:

Walls properly prepared to receive dense pack insulation

Specification(s):

Using fill tube, 100% of each cavity will be filled to a consistent density:

- Blown fiberglass, mineral fiber, rock and slag wool, or spray foam used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cubic feet per minute per square foot at 50 pascals
- Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot when the wall sheathing and interior cladding will endure this level of pressure
- Loose fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density in accordance with manufacturer specifications
- The number of bags installed will be confirmed and will match the number to achieve 1.5-1.6 pounds per cubic foot
- Insulation will be verified to prevent visible air movement using chemical smoke at 50 pascals of pressure difference

Objective(s):

Eliminate voids and settling

Minimize framing cavity air flows

4.1104.1a

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If skirting overlaps siding, skirting will be detached to allow access to the wall cavity

Fasteners will be removed from the bottom of the siding, working upward until the siding can be pulled away from the framing approximately 6" without damaging the siding

Temporary fasteners will be installed near the bottom of the siding panels at the seams to prevent separation

If a subsheathing is present under the siding, access through the subsheathing will be required

Objective(s):

Gain access to the wall cavity without damaging or separating the siding

4.1104.1b

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Wall cavities will be inspected for moisture damage, pest locations, and integrity of the wiring, and holes to the interior

Siding will be repaired as necessary

Location of belt rails, obstructions, and existing insulation will be identified

All interior surfaces of exterior walls will be inspected for loose paneling joints, occupant wall hangings, location of switches and outlets, and other wall obstructions

Objects will be removed from the interior surfaces of the walls being insulated

Interior paneling will be repaired as necessary

Objective(s):

Prepare wall cavity for insulation

Prevent water leaks from occurring

4.1104.1c

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A sheet of polycarbonate, such as Lexan, will be cut to the following specifications to create a stuffer tool:

- Approximately 1' x 8' x ¼" with a 5 degree bend 7' ½" from the bottom
- All corners of the Lexan (polycarbonate) will be rounded and all edges will be sanded

Other clear sheet plastics will not be used due to a tendency to shatter under stress

Objective(s):

Create a tool to install a fiberglass batt into the cavity

Ensure worker safety

4.1104.1d

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Thickness of the batt will fill the void without deforming siding or damaging structure

Fiberglass batts will fill the cavity (e.g., batt may be cut approximately 1" longer to ensure proper fill and allow for lap at the top)

Flexible membrane will have an appropriate perm rating for the region

Flexible membrane will be cut 2" wider than the cavity and approximately 1' longer than the batt

Stuffer tool, membrane, and fiberglass batt will be aligned for installation

Stuffer tool will be used to install the fiberglass batt and membrane at the same time

Excess fiberglass batt and membrane vapor retarder extending below the cavity will be rolled and tucked into the cavity

A poly-encased fiberglass batt may be used in place of the fiberglass batt and membrane assembly

The membrane will be installed in contact with the side of the wall that is compatible with the local climate zone

Objective(s):

Maintain integrity of the batt

Aid in the installation process

4.1104.1e

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Subsheathing will be patched or repaired as necessary

Objective(s):

Ensure the integrity of the drainage plane

4.1104.1f

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If skirting was removed, skirting will be reinstalled to shed water to the outside of the skirting

Siding will be reattached with new fasteners

Siding will be reattached without bulges or wrinkles

Objective(s):

Ensure the integrity of the drainage plane

Return siding to existing conditions without damage

4.1104.1g

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1104.2a

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If skirting overlaps siding, skirting will be removed

Fasteners will be removed from the bottom of the siding, working upward until the siding can be pulled away from the framing approximately 6" without damaging the siding

Temporary fasteners will be installed near the bottom of the siding panels at the seams

If a subsheathing is present under the siding, access through the subsheathing will be required

Objective(s):

Gain access to the wall cavity without causing damage or separation of the siding

4.1104.2b

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Moisture damage
- Presence of infestation or pests
- Location and integrity of wiring
- Holes to the interior and exterior
- Loose paneling or siding
- Location of belt rails
- Location of wall obstructions (switches, outlets)
- Existing insulation
- Wall hangings for removal during work

Problems will be corrected before work begins

Objective(s):

Prepare wall cavity for insulation

Prevent water leaks

4.1104.2c

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Hose outlet pressure will be set according to manufacturer specifications

Objective(s):

Achieve uniform insulation density and coverage

4.1104.2d

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Insulation will meet a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84

Insulation will be installed to a density of 1.5 to-1.6 pounds per cubic foot

Using fill tube, 100% of each cavity will be filled to a consistent density

Special precaution will be taken not to overfill the bottom of the cavity

Fill tube will be inserted from the bottom of the wall cavity within 6" of the top of the cavity between the interior paneling and any existing insulation

Objective(s):

Fire safety maintained

Fill entire wall cavity to the prescribed R-value to reduce air infiltration

Ensure bottom portion of siding will reattach properly

Avoid clogging of the cavity and the fill tube

4.1104.2e

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Subsheathing will be patched or repaired as necessary

Objective(s):

Ensure the integrity of the drainage plane

4.1104.2f

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

If skirting was removed, skirting will be reinstalled to shed water to the outside of the skirting

Siding will be reattached with new fasteners

Siding will be reattached without bulges or wrinkles

Objective(s):

Ensure the integrity of the drainage plane

Reattach siding without damage

4.1104.2g

Desired Outcome:

Consistent thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed Comply with 16 CFR 460.17

4.1104.3a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

With T-111, OSB, or plywood type siding:

- Access to exterior wall cavities will be gained and sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers
- Drilled holes will be large enough to accommodate an appropriately sized fill tube
- Holes will be drilled around the perimeter of the home, parallel to the bottom plate and an equal distance apart
- The line of holes will be located under the lowest window sill when possible

With lap siding:

- Course of siding will be unhooked or removed
- Holes sufficiently large for the fill tube will be drilled in every wall cavity

Objective(s):

Gain access to the wall cavity

Ensure holes are easily covered with an aesthetically pleasing trim strip

4.1104.3b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Installer prework assessment will be conducted to determine:

- Moisture damage
- Presence of infestation or pests
- Location and integrity of wiring
- Holes to the interior and exterior
- Loose paneling or siding
- Location of belt rails
- Location of wall obstructions (switches, outlets)
- Existing insulation
- Wall hangings for removal during work

Problems will be corrected before work begins

Objective(s):

Prepare wall cavity for insulation

Prevent water leaks

4.1104.3c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Blowing machine pressure test will be performed with air on full, feed off, and gate closed

Hose outlet pressure will be set in accordance with manufacturer specifications

Objective(s):

Ensure machine is capable of delivering uniform insulation density and coverage

4.1104.3d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Flame spread and smoke-developed index for insulation will meet a flame spread rating of 25 or less and a smoke development rating of 450 or less when tested in accordance with ASTM E84

Insulation will be installed to a density of 1.5 to 1.6 pounds per cubic foot

Using fill tube, 100% of each cavity will be filled to a consistent density

Fill tube will be inserted within 6" of the top of the cavity between the interior paneling and any existing insulation

Objective(s):

Fill entire wall cavity to the prescribed R-value to reduce air infiltration

Avoid clogging of the cavity and the fill tube

Fire safety will be maintained

4.1104.3e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Holes will be plugged and sealed

Objective(s):

Ensure the integrity of the drainage plane

4.1104.3f

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

For T-111 and equivalent siding:

- A preprimed trim will be centered and installed over the holes
- Height of the trim will span from 1" above to 1" below the hole
- A continuous caulk seal will be applied between the trim and siding
- Caulk seal will be above the holes
- Top edge of the trim will be sealed to the siding with a continuous caulk seal

For lap siding:

- Siding will be reattached without bulges or wrinkles
- Siding will be hooked into the original position

Objective(s):

Ensure the integrity of the drainage plane

Return siding to existing conditions without damage

4.1104.3g

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1104.4a

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

All interior surfaces of the cavities planned to be insulated will be inspected for loose paneling joints, occupant wall hangings, and other wall obstructions

Objects will be removed from the interior surfaces of the exterior walls as needed

Interior paneling will be repaired and secured as necessary

Holes will be drilled from the interior of the house

A hole no larger than the spray nozzle will be drilled in each cavity above the door or window

When possible, the hole will be drilled in the panel groove

Objective(s):

Prepare wall cavity for insulation

Prevent damage from overspray to occupant possessions

4.1104.4b

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Cavity will be probed to assess conditions and volume of cavity

Objective(s):

Determine the approximate amount of foam to be installed in the cavity

4.1104.4c

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

Flame spread index of foam insulation will not exceed 75 and a smoke- developed index of no more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723

Foam insulation will be separated from the interior of the building by an approved thermal barrier at a minimum of 1/2" gypsum wallboard or a material that is tested in accordance with the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275

Two-part foam selection will be based on regional considerations

100% of each cavity will be filled to a consistent density without bulging of panels or siding

Objective(s):

Fill entire wall cavity to the prescribed R-value to reduce air infiltration

Fire safety will be maintained

4.1104.4d

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A color-corresponding sealant will be applied to the access hole

Objective(s):

Ensure wall is aesthetically pleasing

4.1104.4e

Desired Outcome:

Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1302.1a

Desired Outcome:

Belly floor cavity ready for insulation

Specification(s):

Gas, water, waste, and electrical lines will be checked for:

- Plumbing leaks
- Gas/oil leaks
- Attachment
- Standing water
- Raw sewage
- Pests

Objective(s):

Ensure that floor space is safe and ready for work

Verify scope of work

4.1302.1b

Desired Outcome:

Belly floor cavity ready for insulation

Specification(s):

Where bottom board/rodent barrier is missing or damaged and accessible, the following will be ensured:

- Duct sealing completed
- Gas, water, and electrical lines secured at least every 4' to a floor joist or framing member
- Water line will be located on the warm side of the insulation; if not, the water lines will be insulated appropriately
- No water or gas leaks are present
- Waste lines are sloped to 1/4" per foot
- Bottom board/rodent barrier is sound/strong enough to support insulation

When bottom board is intact, the following will be ensured:

- Holes and penetrations in the bottom board and decking sealed
- Duct sealing completed
- No water or gas leaks present
- Bottom board is sound/strong enough to support insulation
- Water lines are secured to the floor joists/warm side of the insulation; if not, the water lines will be insulated appropriately

Problems will be corrected before floor cavity insulation work begins

Objective(s):

Ensure problems are corrected before floor cavity insulation work begins

Keep pipes from freezing

4.1303.1a

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation will be installed in accordance with recommended R-value and density

Objective(s):

Insulate to prescribed R-value for the climate zone

4.1303.1b

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Road and rodent barrier must be intact and free from holes and capable of supporting the insulation

Objective(s):

Ensure bottom board is intact

Ensure insulation is supported

Protect cavity from infestation

4.1303.1c

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Each cavity will be insulated to specified R-value and density

The number of bags installed will be confirmed and will match the number required on the coverage chart

Objective(s):

Eliminate voids and settling

4.1303.1d

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Flame spread index of selected materials will not exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E84 or UL 723

Flame spread index of foam insulation will not exceed 75 and a smoke- developed index of no more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723

Foam insulation will be separated from the interior of the building by an approved thermal barrier at a minimum of 1/2" gypsum or a material that is tested in accordance with the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275

Selected material will be of minimal water absorbency

Selected material will be noncorrosive

Objective(s):

Ensure durability

Prevent moisture damage

Fire safety will be maintained

4.1303.1e

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Insulation type
- Coverage area
- R-value
- Installed thickness and minimum settled thickness
- Number of bags installed in accordance with manufacturer specifications

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Ensure ability to match bags required for total area completed

Comply with 16 CFR 460.17

4.1303.2a

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation will be installed in accordance with recommended R-value and density

Objective(s):

Insulate to prescribed R-value for the climate zone

4.1303.2b

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Ensure complete accessibility of floor cavity

Clean floor cavities

Remove all remnants of previous insulation and bottom board

Objective(s):

Ensure work area is clean, safe, and ready to accept insulation

4.1303.2c

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Each cavity will be insulated to specified R-value and density

If insulation has facing, facing will be in contact with the heated side

Insulation will be in contact with subfloor

Insulation will not have gaps, voids, or be compressed

Insulation will be supported (e.g., metal insulation supports) to maintain a permanent contact with subfloor

Insulation will be notched around all wires, pipes, and blocks

Ducts and water lines will be insulated for climate conditions

Water lines will be located above the warm side of the insulation (toward the conditioned space), when feasible

A rigid air barrier will be installed in contact with the bottom of the joists, when feasible

Rigid air barrier will be fastened as to not sag, bend, or fall off

Seams, holes, and joints in the air barrier will be sealed

In cases where HVAC ducts hang below the level of the rigid air barrier and insulation, the ducts will be insulated and air barrier provided that is sealed to the rigid air barrier

Objective(s):

Eliminate voids

Minimize conductive heat transfer across the floor system

Ensure durability

Minimize convective heat transfer

Keep pipes from freezing

4.1303.2d

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation materials will be of minimal water absorbency and flame spread, and smoke-developed index for insulation will be in accordance with 2012 IRC 2012, Sections R302.10.1 through R302.10.5

Foam plastic insulation will comply with 2012 IRC 2012, Section R316

Fasteners will be corrosion resistant

Objective(s):

Ensure durability

Prevent moisture damage

4.1303.2e

Desired Outcome:

Consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1303.3a

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation will be installed in accordance with recommended R-value

Objective(s):

Insulate to prescribed R-value for the climate zone

4.1303.3b

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Ensure complete accessibility of floor cavity

Objective(s):

Ensure work area is clean, safe, and ready to accept insulation

4.1303.3c

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

All floor areas will be open and accessible for spray foam application

Any openings in the subfloor larger than ¼" will be covered with appropriate materials

Insulation dams or end blockers will be installed where needed

All surfaces where spray foam is applied will be clean, dry, and free of contamination and degradation

Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt

Grease and oil will be removed using appropriate cleaners or solvents

Moisture content of all wood substrate materials will be below 19%; if tested at or above this percent of moisture, insulating the floor will be deferred until moisture level is corrected

Clean floor cavities

Remove all remnants of previous insulation and bottom board

Objective(s):

Prepare all substrate surfaces for the application of spray foam

4.1303.3d

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation will be installed to prescribed R-value in accordance with manufacturer specifications

In accordance with manufacturer specifications, spray foam will be applied to desired thickness using the maximum pass thickness onto subfloor between floor joists and all rim/band joists

Rim/band joist will be sealed

When desired, underside of joists will be covered with spray foam to provide a layer of continuous insulation

Each cavity will be insulated to specified R-value

Insulation must be in contact with subfloor

Insulation will not have gaps or voids

Ducts and water lines will be insulated for climate conditions

Objective(s):

Insulate and seal floors

Eliminate voids

Minimize conductive and convective heat transfer across the floor system

Ensure durability

4.1303.3e

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Insulation will be installed in accordance with manufacturer specifications

Flame spread index of selected materials will not exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84 or UL 723

Flame spread index of foam insulation will not exceed 75 and a smoke- developed index of no more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723

Foam insulation will be separated from the interior of the building by an approved thermal barrier at minimum 1/2" gypsum or a material that is tested in accordance with the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275

Objective(s):

Ensure durability

Ensure worker safety

Ensure proper installation

Fire safety will be maintained

4.1303.3f

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

Spray foam will be separated from the occupied space of the building with a 15-minute thermal barrier (typically 15/32" sheathing, 1/2" gypsum board, or approved thermal barrier coating) or as approved by ASTM E84 requirements

Spray foam designed to be used as a fire block does not require a thermal barrier installed prior to application

Objective(s):

Provide necessary fire protection for combustible spray foam insulation

4.1303.3g

Desired Outcome:

Installation of a consistent thermal boundary between conditioned and unconditioned space that reduces heat flow

Specification(s):

A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):

Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1402.2a

Desired Outcome:

Basement insulation improves thermal performance and ensures sufficient drying potential

Specification(s):

Regional IECC will be followed for required R-values

Objective(s):

Improve thermal performance of the basement and living space

4.1402.2b

Desired Outcome:

Basement insulation improves thermal performance and ensures sufficient drying potential

Specification(s):

A continuous air barrier will be installed on the warm side of the insulation

Objective(s):

Prevent condensation on the basement wall

4.1402.2c

Desired Outcome:

Basement insulation improves thermal performance and ensures sufficient drying potential

Specification(s):

When absorbent insulation materials are installed, assembly will remain vapor permeable to the interior in all climate zones except Zone 7(<http://energycode.pnl.gov/EnergyCodeReqs/>)

Objective(s):

Provide drying potential to the basement

4.1601.3a

Desired Outcome:

Minimize condensation

Specification(s):

Ducts will have continuous insulation and vapor barrier

Insulation will be sufficient to prevent dew point on surface of ducts

Objective(s):

Minimize condensation

4.1601.3b

Desired Outcome:

Minimize condensation

Specification(s):

Inspection and/or testing will be conducted to determine whether ducts are within thermal, pressure, and vapor boundary

If ducts are within thermal, pressure, and vapor boundary, no action will be required

If ducts are not within thermal, pressure, and vapor boundary, continuous air barrier, insulation, and vapor retarder will be installed either on the ducts or at the belly liner

Objective(s):

Minimize condensation

4.1601.3c

Desired Outcome:

Minimize condensation

Specification(s):

All exposed metal will have continuous insulation and vapor retarder

Objective(s):

Minimize condensation

4.1601.5a

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Duct insulation will be a minimum of R-8, in accordance with local code or buried under attic insulation, whichever is a greater R-value, and have an attached and continuous vapor barrier

Hot humid and warm coastal regions will not bury ducts

Objective(s):

Decrease heat loss and condensation problems

4.1601.5b

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

All accessible ducts will be sealed with a UL-181 mastic before insulation is applied

Objective(s):

Minimize duct leakage

4.1601.5c

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Duct insulation will be mechanically fastened (e.g., stitch staples, tie bands) and sealed with no exposed metal

Duct insulation will be secured to the duct system using metal wire or rot-proof nylon twine

Pattern of the wire or twine will be sufficient to securely hold the duct insulation tight to the duct

Mechanical fastening will be sufficient to securely hold the duct insulation in place and tight to the duct

Objective(s):

Ensure a secure connection between the duct system and the duct insulation

Ensure performance of the installed material

Minimize condensation

4.1601.5d

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Using a tape approved by the manufacturer, all seams and connection of the vapor barrier will be taped so that no metal is exposed

No gaps will exist between pieces of duct insulation

Objective(s):

Prevent gaps in the vapor barrier of the insulation

4.1601.5e

Desired Outcome:

Lowered thermal conductance of duct system and minimized condensation on the duct system

Specification(s):

Vermin access points will be identified and treated appropriately (e.g., seal access holes)

Objective(s):

Ensure long-term durability of the building materials

4.9901.1a

Desired Outcome:

To provide general Information on spray polyurethane foam

Specification(s):

Low-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in pressurized canisters (~250 psi), dispensed through unheated hoses through a disposable mixing nozzle system, and applied as a froth-like material to substrate. This type of SPF product is typically used for large sealing and small-scale insulation products.

Objective(s):

To provide general Information on spray polyurethane foam

4.9901.1b

Desired Outcome:

To provide general Information on spray polyurethane foam

Specification(s):

High-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in unpressurized drums or totes, and dispensed by a proportioner pump where heat and pressure are added. These chemicals travel through heated hoses to a spray gun where the material is aerosolized during application. This type of SPF product is typically used for larger insulation applications.

Once installed, there is essentially no difference in product performance between low- and high-pressure foams. It should be noted that the main differences between the delivery methods are in capital equipment investment, application rate, and PPE requirements.

Applicators should obtain training from the suppliers of SPF to help assure installation quality and use of all equipment as well as safe handling, use, and disposal of all chemicals used in the process. Spray Polyurethane Foam Alliance (SPFA) also offers additional training and accreditation for high-pressure SPF applicators.

Objective(s):

To provide general Information on spray polyurethane foam

4.9901.1c

Desired Outcome:

To provide general Information on spray polyurethane foam

Specification(s):

In addition to the guidelines above, SPF applicators should follow all manufacturer installation instructions for the product being used. These instructions include product-specific documents, such as application instructions, MSDSs, and evaluation reports.

Objective(s):

To provide general Information on spray polyurethane foam

5.3001.3a

Desired Outcome:

Effective, efficient, safe, and durable return air system

Specification(s):

Existing return air openings will be closed off and sealed with a durable material equivalent in strength to the surrounding material

Disturbed materials suspected to contain asbestos or lead content will be assessed and removed in accordance with EPA regulations

Objective(s):

Minimize air leakage

Improve indoor environmental quality

Ensure safe and legal renovation

- The costs associated with the testing and remediation of Asbestos materials are not eligible expenditures in the *Nebraska Weatherization Assistance Program*.

5.3001.3b

Desired Outcome:

Effective, efficient, safe, and durable return air system

Specification(s):

Alternate return air opening will be provided to the furnace closet (e.g., replace louvered door or install grilles); whenever possible, follow manufacturer specifications for amount needed

Return duct design will be in accordance with ANSI/ACCA 1 Manual D Residential Duct Systems

A continuous and adequate return air pathway to the air handler will be installed

Objective(s):

Ensure sufficient return air is provided to the system

5.3001.3c

Desired Outcome:

Effective, efficient, safe, and durable return air system

Specification(s):

Pressures will be measured with the furnace fan operating across interior doors that can be closed and have a supply and/or return behind them

Rooms should not exceed 3 pascals of pressure

Pressure testing will be performed with all interior doors closed and the air handler running

Objective(s):

Ensure sufficient return air is provided to the system

Minimize moisture intrusion from negative pressures

Improve indoor air quality

5.3001.3d

Desired Outcome:

Effective, efficient, safe, and durable return air system

Specification(s):

CAZ testing will be performed where combustion appliances are utilized

Objective(s):

Identify unsafe equipment operating conditions

5.3001.3e

Desired Outcome:

Effective, efficient, safe, and durable return air system

Specification(s):

Occupant will be educated on changes, how to operate and maintain the system, and any potential health concerns (e.g., lead, asbestos)

Objective(s):

Ensure occupant is educated

5.3003.1a

Desired Outcome:

Data for commissioning and future service work is recorded

Specification(s):

Equipment will be visually inspected

Information will be recorded from the equipment data plates indoors and outdoors

Objective(s):

Ensure technician has equipment data necessary for commissioning and future service work

5.3003.3a

Desired Outcome:

Air flow is properly tested

Specification(s):

Total system air flow will be measured by:

- Temperature rise
- Flow plate
- Fan depressurization device (e.g., Duct Blaster, DucTester)

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3b

Desired Outcome:

Air flow is properly tested

Specification(s):

External static pressure will be in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3c

Desired Outcome:

Air flow is properly tested

Specification(s):

Pressure drop across cooling coils will be in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3d

Desired Outcome:

Air flow is properly tested

Specification(s):

Pressure drop across filter will be in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3e

Desired Outcome:

Air flow is properly tested

Specification(s):

Air flow will be measured at each register to ensure proper air flow delivery

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3f

Desired Outcome:

Air flow is properly tested

Specification(s):

Supply wet bulb and dry bulb air temperatures will be recorded

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3g

Desired Outcome:

Air flow is properly tested

Specification(s):

Return wet bulb and dry bulb air temperatures will be recorded

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.3h

Desired Outcome:

Air flow is properly tested

Specification(s):

Temperature rise between the supply and return will be in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Provides comfort
- Operates safely
- Is durable

5.3003.5a

Desired Outcome:

Refrigerant lines properly installed

Specification(s):

All liquid refrigerant lines will be insulated to a minimum of R-4

Vapor or high side lines will not be insulated unless specified by the equipment's manufacturer

Suction lines will be insulated to a minimum of R-4

For mixed humid, hot humid, and marine climates, heating and cooling refrigerant lines will be insulated

Objective(s):

Ensure refrigerant lines do not gain excessive heat

Prevent energy loss and condensation

5.3003.5b

Desired Outcome:

Refrigerant lines properly installed

Specification(s):

If exposed to sunlight, refrigerant line insulation will be protected from UV degradation in accordance with manufacturer specifications, 2012 IRC N1103.3.1, or local code

Objective(s):

Install insulation so it does not degrade

5.3003.5c

Desired Outcome:

Refrigerant lines properly installed

Specification(s):

Refrigerant lines will be sized to meet manufacturer specifications for the installed equipment

Objective(s):

Ensure system moves appropriate volume of refrigerant

5.3003.5d

Desired Outcome:

Refrigerant lines properly installed

Specification(s):

Refrigerant lines will be installed without kinks, crimps, or excessive bends

Objective(s):

Ensure system moves appropriate volume of refrigerant

5.3003.5e

Desired Outcome:

Refrigerant lines properly installed

Specification(s):

Refrigerant lines will be routed, supported, and secured to house in a manner that protects the line from damage by workers or occupants

Objective(s):

Ensure refrigerant lines do not move, vibrate, or sag

Protect lines from damage

5.3003.7a

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Basic operation of the equipment will be explained to the occupant (e.g., design conditions, efficiency measures, differences from previous system or situation)

Objective(s):

Ensure occupant has a reasonable expectation of the equipment's capability

5.3003.7b

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Proper operation and programming of system controls to achieve temperature and humidity control will be explained to the occupant

Objective(s):

Ensure occupant can operate system controls

5.3003.7c

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Indoor and outdoor electrical disconnects and fuel shut-offs will be demonstrated to occupant

Objective(s):

Ensure occupant can shut off equipment in emergencies

5.3003.7d

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Location of combustion air inlets will be identified for occupant in accordance with NFPA 31, 54, and 58

Importance of not blocking inlets will be explained to occupant

Objective(s):

Ensure occupant does not block combustion air inlets

5.3003.7e

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Importance of cleaning dust and debris from return grilles will be explained to occupant

Proper placement of interior furnishings with respect to registers will be explained to occupant

Negative consequences of closing registers will be explained to occupant

Importance of leaving interior doors open as much as possible will be explained to occupant

Objective(s):

Ensure occupant does not prevent equipment from operating as designed

5.3003.7f

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Proper filter selection and how to change the filter will be explained to occupant

Importance of keeping outside unit clear of debris, vegetation, decks, and other blockage will be explained to occupant

Importance and timing of routine professional maintenance will be explained to occupant

Objective(s):

Ensure equipment operates as designed

5.3003.7g

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Situations when the occupant should contact the HVAC contractor will be explained, including:

- Fuel odors
- Water draining from secondary drain line
- Emergency heat indicator always on for a heat pump system
- System blowing cold air during heating season and vice versa
- Icing of the evaporator coil during cooling mode
- Outside unit never defrosts
- Unusual noises
- Unusual odors

Objective(s):

Notify occupant to contact installer when system is not operating as designed

5.3003.7h

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

A carbon monoxide (CO) alarm will be installed

Objective(s):

Occupant will be made aware of operation of CO alarm

- The installation of Carbon Monoxide Detectors is required when none are present or the existing unit is inoperable and a combustion appliance(s) is present or the home has an attached garage.

5.3003.7i

Desired Outcome:

Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Occupant will be provided with relevant manuals and warranties

The labor warranty will be explained and the occupant will be given a phone number to call for warranty service

Objective(s):

Provide manuals and warranties for future servicing

5.3003.11a

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Mercury-based thermostat will be removed safely and disposed of in accordance with EPA regulations

Objective(s):

Protect workers and occupants from injury

Protect environment from damage

5.3003.11b

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Existing controls will be removed in accordance with EPA lead safe work rules

Objective(s):

Protect workers and occupants from injury

Protect environment from damage

5.3003.11c

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Penetrations for control wiring will be sealed with a durable sealant (e.g., caulk, silicone, foam) at both the interior (e.g., floor, sheetrock) and exterior air barriers (e.g., bottom liner, side walls)

Objective(s):

Ensure controls operate as designed

Minimize infiltration and exfiltration from house

5.3003.11d

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Thermostats will be installed to reflect the temperature of the zone in which they are installed

Mounting location for air leakage and conductance that would affect the thermostat operation (e.g., marriage walls, exterior walls) will be accessed

Thermostats will not be exposed to extreme temperatures, radiant heat sources, and drafts

Objective(s):

Ensure controls operate as designed

5.3003.11e

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Blower speed will be set for equipment in accordance with manufacturer specifications

Objective(s):

Ensure equipment has correct air flow

5.3003.11f

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

A thermostat with supplementary heat lockout that can interface with an outdoor temperature sensor will be selected

Objective(s):

Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load

5.3003.11g

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Supplementary heat lockout on air-to-air heat pumps will be set to the economical balance point

ANSI/ACCA 3 Manual S-2004 Residential Equipment Selection will be referenced for set points when using different types of heat pumps

Objective(s):

Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load

5.3003.11h

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

For air-to-air heat pumps, low ambient compressor lockout will be set to 0°F outdoor temperature or ambient compressor lockout will be disabled

ANSI/ACCA 3 Manual S-2004 Residential Equipment Selection will be referenced for low ambient compressor lockout when using different types of heat pumps

Objective(s):

Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load

5.3003.11i

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

An outdoor temperature sensor will be installed in accordance with manufacturer specifications

Objective(s):

Ensure equipment operates as designed

5.3003.11j

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Supplementary heat will be wired onto second stage heating terminal in accordance with manufacturer specifications

Objective(s):

Do not operate supplementary heat in stage one heating

5.3003.11k

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

The installer options will be set to match the thermostat to the equipment and control board settings

Objective(s):

Ensure equipment operates as designed

5.3003.11I

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Time delay for equipment will be set in accordance with manufacturer specifications and as appropriate for the climate zone (e.g., no time delay for hot humid climates)

Objective(s):

Maximize transfer of heat without adversely affecting indoor humidity levels

5.3003.11m

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Humidistat will be installed to reflect humidity of the zone in which it is installed

Humidistat will be installed in a dry location

Objective(s):

Ensure controls operate as designed

- The costs associated with the installation of humidistats are not eligible expenses in the *Nebraska Weatherization Assistance Program*.

5.3003.11n

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Ventilation controls will be connected to operational control system, as originally designed in the factory

Powered ventilation system alarm will be set to "on;" controls will be reset to factory settings

Objective(s):

Ensure proper operation of the mechanically dampered and powered ventilation systems

5.3003.11o

Desired Outcome:

Heating and cooling controls installed and set properly

Specification(s):

Occupants will be educated on proper use of thermostat, including:

- Proper use of setbacks for air conditioners and heat pumps
- Allowing occupant comfort to determine setback for combustion heating appliances
- Using emergency heat appropriately
- Educate property manager/occupant about fan on/auto or vent/auto operations
- Educate the property manager/occupant about ventilation, as it applies to controls
- Instruct the property manager/occupant to never leave the fan set to "on" or "vent" in humid climates
- Educate property manager/occupant about possible moisture problems when thermostat is set low for extended periods of time during the summer

Objective(s):

Ensure equipment and controls operate as designed

Provide comfort throughout house

Ensure property manager/occupant knows how to operate the system

Minimize moisture problems

5.3003.14a

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

Heating equipment will be placed in operation in accordance with applicable NFPA standards and manufacturer specifications when available

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.14b

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

Measurement will be verified by a certified professional in accordance with fuel type and manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.14c

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

Measurement will be verified in accordance with industry manuals (e.g., Testo, Bacharach)

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.14d

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

Excess combustion air will be calculated and verified in accordance with industry manuals (e.g., Testo, Bacharach)

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.14e

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

CO in the undiluted flue gas will be less than 100 ppm

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.14f

Desired Outcome:

Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

Specification(s):

All testing and inspection holes will be sealed with manufacturer approved materials

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15a

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Smoke test will be conducted before any combustion testing is completed

Smoke spot reading will be in accordance with burner manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15b

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Nozzle size, angle, and spray pattern will be correct for design input and within equipment firing rate of the heating system manufacturer

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15c

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Filter will be present, clean, and leak free

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15d

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Measurement will be verified in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15e

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Measurement will be verified in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15f

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Net stack temperature will be measured and verified in accordance with manufacturer specifications

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15g

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Measurement will be verified in accordance with industry manuals (e.g., Testo, Bacharach)

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15h

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

Excess combustion air will be calculated and shown to be in accordance with industry manuals (e.g., Testo, Bacharach)

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15i

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

CO in the undiluted flue gas will be less than 100 ppm

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.15j

Desired Outcome:

Analysis of critical components and operations completed to industry and manufacturer specifications

Specification(s):

All testing and inspection holes will be sealed with approved materials

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely
- Operates efficiently
- Is durable

5.3003.16a

Desired Outcome:

Electrical components properly tested

Specification(s):

Homes will have a four-wire service entrance to the panel box to ensure a wiring system that is nominally rated at 120/240 volts and allows for proper grounding

Grounding at the service entrance will be checked to determine proper grounding of the home

Objective(s):

Ensure occupant and worker safety

5.3003.16b

Desired Outcome:

Electrical components properly tested

Specification(s):

Polarity of equipment will be verified by a qualified technician if wiring is to be modified or repaired

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely

5.3003.16c

Desired Outcome:

Electrical components properly tested

Specification(s):

Voltage will be in accordance with manufacturer specifications

Objective(s):

Ensure equipment operates as designed

5.3003.16d

Desired Outcome:

Electrical components properly tested

Specification(s):

Voltage drop will be within acceptable range in accordance with manufacturer specifications

Objective(s):

Ensure contactor does not overheat

Ensure equipment operates as designed

5.3003.16e

Desired Outcome:

Electrical components properly tested

Specification(s):

Grounding will be connected in compliance with local code requirements, ANSI/NEMA GR 1-2007, and NFPA 70 National Electric Code

Frames of home sections will be bonded with copper wire

Bonding lug will be selected to prevent corrosion due to dissimilar metals

Objective(s):

Ensure equipment:

- Operates as designed
- Operates safely

Ensure ground continuity among sections

5.3003.16f

Desired Outcome:

Electrical components properly tested

Specification(s):

Amperage will not exceed manufacturer full load amperage

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Operates safely

5.3003.16g

Desired Outcome:

Electrical components properly tested

Specification(s):

Amperage will not exceed manufacturer full load amperage

Objective(s):

Ensure equipment:

- Operates as designed
- Operates efficiently
- Operates safely

5.3003.16h

Desired Outcome:

Electrical components properly tested

Specification(s):

Blower compartment safety switch operation will be verified, if present

Objective(s):

Ensure blower:

- Does not operate during service
- Cannot backdraft a flue when the door is off

5.3003.16i

Desired Outcome:

Electrical components properly tested

Specification(s):

Emergency heat circuit functions will be verified

Objective(s):

Ensure system delivers heat in case of compressor failure

6.6002.3a

Desired Outcome:

Exhaust grille location optimizes either primary or local ventilation

Specification(s):

Fan intake grille will be installed in a central location within the main body of the house

Ensure it is accessible for filter change and cleaning

Objective(s):

Provide whole house air exchange

6.6002.3b

Desired Outcome:

Exhaust grille location optimizes either primary or local ventilation

Specification(s):

Fan intake grille will be installed in the space where odor, moisture vapor, or other contaminants are generated

Objective(s):

Remove contaminated air at the source

6.6002.4a

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Consideration will be given to:

- Vent termination location
- Amount of space for duct run
- Roof condition, type, and access (e.g., metal, shingle, bow string, flat)
- Duct insulation

When applicable, pitch duct to remove condensation to outdoors

Ducts will be as straight as possible, fully extended, and have the shortest run possible

Turns will be made so the radius at the centerline is no less than one duct diameter

Duct diameter will be equal to or greater than the exhaust fan outlet

Fan flow will be verified by flow measurement to meet ASHRAE Standard 62.2

Objective(s):

Effectively move the required volume of air

6.6002.4b

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Ducts installed outside of the thermal envelope will be insulated to a minimum of R-8 or in accordance with local codes

Objective(s):

Prevent condensation from forming or collecting inside or outside of the ductwork

6.6002.4c

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Horizontal runs will be supported in accordance with flex duct manufacturer specifications and local codes

Supports with a width of at least 1 ½" will be used or adequate metal support

Objective(s):

Effectively move the required volume of air

Preserve the integrity of the duct system

6.6002.4d

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Metal-to-metal or metal-to-PVC connections will be fastened with a minimum of three equally spaced screws

Flexible duct-to-metal or flexible duct-to-PVC connections will be fastened with tie bands using a tie band tensioning tool

PVC-to-PVC connections will be fastened with approved PVC cement

Other specialized duct fittings will be fastened in accordance with manufacturer specifications

In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

Objective(s):

Effectively move the required volume of air

Preserve the integrity of the duct system

6.6002.4e

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Flexible materials will be UL 181 listed or Air Diffusion Council approved

Rigid, smooth metal of 30-gauge wall thickness or thicker will be used

PVC material may be used

Objective(s):

Effectively move the required volume of air

Preserve the integrity of the duct system

6.6002.4f

Desired Outcome:

Installed ducts effectively move the required volume of air and prevent condensation

Specification(s):

Total exhaust system ventilation airflow will be measured

Objective(s):

Ensure air flow is as designed

6.6003.1a

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

A hole no greater than a 1/4" greater than the assembly will be cut to accommodate fan assembly

Objective(s):

Minimize repair work

Ensure a secure installation

6.6003.1b

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Wiring will be installed by a properly licensed contractor, as required by the authority having jurisdiction

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Objective(s):

Prevent an electrical hazard

6.6003.1c

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Fan outlet will be oriented toward the final termination location

Fan will be oriented so the equivalent length of the duct run is as short as possible

Fan will be mounted securely in accordance with manufacturer specifications

Objective(s):

Ensure short duct run to achieve optimum air flow

Ensure a secure installation

Ensure fan housing does not shake, rattle, or hum when operating

6.6003.1d

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

A backdraft damper will be installed between the outlet side of the fan and the exterior

Objective(s):

Prevent reverse air flow when the fan is off

6.6003.1e

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Duct-to-fan outlet will be connected and sealed as follows:

- Round metal-to-metal or metal-to-PVC connections will be fastened with a minimum of three equally spaced screws
- Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes
- Flexible duct-to-metal or flexible duct-to-PVC connections will be fastened with tie bands using a tie band tensioning tool
- PVC-to-PVC connections will be fastened with approved PVC cement
- Other specialized duct fittings will be fastened according to manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

Objective(s):

Exhaust to outside

6.6003.1f

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Gaps and holes in fan housing will be sealed with caulk or other sealants in accordance with manufacturer recommendations

Sealants will be compatible with their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Objective(s):

Prevent air leakage through fan housing

Ensure a permanent seal

Prevent a fire hazard

6.6003.1g

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Sealants will be compatible with their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Objective(s):

Prevent air leakage between house and fan

6.6003.1h

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Air flows in cubic feet per minute (CFM) will be measured and adjusted to meet the whole house upgrade design requirements

Objective(s):

Exhaust sufficient air from desired locations to outside

6.6003.1i

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Leakage to the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)

Objective(s):

Ensure occupant health and safety

6.6003.1j

Desired Outcome:

Surface-mounted ducted fans installed to specification

Specification(s):

Pressure effects will be assessed and corrected on all combustion appliances

Objective(s):

Ensure safe operation of combustion appliances

6.6003.2a

Desired Outcome:

Inline fans installed to specification

Specification(s):

Wiring will be installed by a properly licensed contractor, as required by the authority having jurisdiction

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Objective(s):

Prevent an electrical hazard

6.6003.2b

Desired Outcome:

Inline fans installed to specification

Specification(s):

Fan and service switch will be accessible for maintenance according to NFPA 70 National Electric Code or local authority having jurisdiction

Objective(s):

Fan and service switch will be accessible for maintenance

6.6003.2c

Desired Outcome:

Inline fans installed to specification

Specification(s):

Fan outlet will be oriented toward the final termination location

Fan will be oriented so the equivalent length of the duct run is as short as possible

Fan will be mounted securely in accordance with manufacturer specifications

Fan will be isolated from the building framing unless specifically designed to be directly attached

Fan will be installed remotely by installing ducting from intake grille

Objective(s):

Ensure short duct run to achieve optimum air flow

Ensure fan is installed securely

Ensure fan housing or building framing does not shake, rattle, or hum when operating

Minimize noise

6.6003.2d

Desired Outcome:

Inline fans installed to specification

Specification(s):

A backdraft damper will be installed between the outlet side of the fan and the exterior

Objective(s):

Prevent reverse air flow when the fan is off

6.6003.2e

Desired Outcome:

Inline fans installed to specification

Specification(s):

Ducts will be connected and sealed to the intake fan and termination fitting as follows:

- Round metal-to-metal or metal-to-PVC connections will be fastened with a minimum of three equally spaced screws
- Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes
- Flexible duct-to-metal or flexible duct-to-PVC connections will be fastened with tie bands using a tie band tensioning tool
- PVC-to-PVC connections will be fastened with approved PVC cement
- Other specialized duct fittings will be fastened in accordance with manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

Objective(s):

Exhaust from desired location to outside

Preserve integrity of the duct system and building envelope

6.6003.2f

Desired Outcome:

Inline fans installed to specification

Specification(s):

Sealants will be compatible with their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Objective(s):

Prevent air leakage around intake housing

Prevent a fire hazard

6.6003.2g

Desired Outcome:

Inline fans installed to specification

Specification(s):

Air flows in CFM will be measured and adjusted to meet the design requirements

Objective(s):

Exhaust sufficient air from desired locations to outside

6.6003.2h

Desired Outcome:

Inline fans installed to specification

Specification(s):

Leakage to the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)

Objective(s):

Ensure occupant health and safety

6.6003.2i

Desired Outcome:

Inline fans installed to specification

Specification(s):

Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Exhaust fans and other exhausting systems shall be provided with makeup air or other pressure relief

Objective(s):

Ensure safe operation of combustion appliances

6.6003.6a

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Clearance for size of the fan recommended will be determined

Consideration will be given for adequate head clearance

Objective(s):

Ensure access for installation, operation, and maintenance

Ensure occupant safety

6.6003.6b

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Power source load will be determined as adequate

Consideration will be given to power source location

Objective(s):

Provide accessible and adequate power source

6.6003.6c

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

No resistance greater than 3 pascals will exist between fan intake location with reference to the common area

Objective(s):

Allow fresh air distribution to common areas

6.6003.6d

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Consideration will be given to:

- Vent termination location
- Amount of space for duct run
- Roof condition and type (e.g., metal, shingle, bow string, flat)
- Duct insulation

When applicable, pitch duct to remove condensation to outdoors

Ducts will be as straight as possible, fully extended, and have the shortest run possible

To the extent possible, turns will be made so that the radius at the centerline is no less than one duct diameter

Duct diameter will be equal to or greater than the exhaust fan outlet

Fan flow will be verified by flow measurement to meet ASHRAE standard 62.2

Objective(s):

Effectively move the required volume of air

6.6003.6e

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Fan will be secured to a structural component

Structural integrity of the manufactured home will be maintained (e.g., roof trusses, walls, floor joists)

Objective(s):

Maintain structural integrity

Maintain fan attachment

6.6003.6f

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Total exhaust system airflow will be measured

Objective(s):

Ensure exhaust airflow is as designed

6.6005.1a

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Clothes dryers will be ducted to the outdoors, which does not include unconditioned spaces, such as attics and crawl spaces that are ventilated with the outdoors

As short a run as practical of rigid sheet metal or semi-rigid sheet metal venting material will be used in accordance with manufacturer specifications

Dryer ducts exceeding 35' in duct equivalent length will have a dryer booster fan installed

Plastic venting material will not be used

Uninsulated clothes dryer duct will not pass through unconditioned spaces, such as attics and crawl spaces

Ducts will be connected and sealed as follows:

- UL-listed foil type or semi-rigid sheet metal to rigid metal will be fastened with clamp
- Other specialized duct fittings will be fastened in accordance with manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

In addition,

- Sheet metal screws or other fasteners that will obstruct the exhaust flow will not be used
- Condensing dryers will be plumbed to a drain

Objective(s):

Preserve integrity of building envelope

Effectively move air from clothes dryer to outside

6.6005.1b

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Termination fitting manufactured for use with dryers will be installed

A backdraft damper will be included, as described in termination fitting detail

Objective(s):

Preserve integrity of building envelope

Effectively move air from clothes dryer to outside

6.6005.1c

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Makeup air will be provided for appliances exhausting more than 200 CFM

Objective(s):

Preserve integrity of building envelope

Effectively move air from clothes dryer to outside

6.6005.1d

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Objective(s):

Ensure safe operation of combustion appliances

Ensure occupant health and safety

6.6005.1e

Desired Outcome:

Dryer air exhausted efficiently and safely

Specification(s):

Occupant will be instructed to keep lint filter and termination fitting clean

Occupant will be instructed to keep dryer booster fan clean, if present

Occupant will be instructed on clothes dryer operation safety, including information on items that must not be placed in the clothes dryer (items with any oil or other flammable liquid on it, foam, rubber, plastic or other heat-sensitive fabric, glass fiber materials)

Objective(s):

Effectively move air from clothes dryer to outside

6.6005.2a

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Wiring will be installed in accordance with local regulations or the 2012 IRC in the absence of such regulations or where those regulations are not as stringent as the 2012 IRC

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Wiring will be installed by a licensed electrician

Objective(s):

Prevent an electrical hazard

6.6005.2b

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Kitchen range fans will be vented to the outdoors

Recirculating fans will not be used as a ventilating device

Objective(s):

Remove cooking contaminants from the house

Preserve integrity of building envelope

6.6005.2c

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Kitchen range fans will be ducted to the outdoors

As short a run as practical of smooth wall metal duct will be used, following manufacturer specifications

Ducting will be connected and sealed as follows:

- Metal-to-metal connections will be fastened with a minimum of three equally spaced screws
- Other metal-to-metal connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes
- For down-draft exhaust systems, PVC-to-PVC connections will be fastened with approved PVC cement
- Other specialized duct fittings will be fastened in accordance with manufacturer specifications
- In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material

Objective(s):

Preserve integrity of building envelope

Effectively move air from range to outside

6.6005.2d

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Termination fitting will be installed including a backdraft damper, as described in termination fitting detail

Objective(s):

Ensure safe operation of combustion appliances

Ensure occupant health and safety

6.6005.2e

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Makeup air will be provided for kitchen range fans exhausting more than 200 CFM

Objective(s):

Ensure safe operation of combustion appliances

Ensure occupant health and safety

6.6005.2f

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Objective(s):

Ensure safe operation of combustion appliances

Ensure occupant health and safety

6.6005.2g

Desired Outcome:

Kitchen range fan installed to specification

Specification(s):

Occupant will be instructed to keep grease filters and termination fitting clean

Objective(s):

Effectively move air from kitchen range to outdoors

6.6102.4a

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Existing forced air system leakage to the outside will be less than 10% of the air handler flow when measured at 25 pascals with reference to the outside

Any portion of the return located inside the Combustion Appliance Zone will be air sealed

Objective(s):

Reduce migration of pollutants

6.6102.4b

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Wiring will be installed by a properly licensed contractor, as required by the authority having jurisdiction

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Objective(s):

Prevent an electrical hazard

6.6102.4c

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Motorized damper and service switch will be accessible for maintenance in accordance with required code or authority having jurisdiction

Objective(s):

Ensure accessibility for maintenance

6.6102.4d

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Ventilation duct will be attached as close to the HVAC system's fan as possible while remaining in compliance with HVAC manufacturer specifications

Filtration of ventilation air will be provided before reaching the thermal conditioning components

Filtration will be accessible and serviceable

Duct will be connected to intake fitting

Connection and seal will be performed in accordance with supply duct detail

Objective(s):

Ensure short duct run to achieve optimum air flow

Preserve integrity of the duct system and building envelope

6.6102.4e

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

A motorized damper or equivalent technology will be installed between the intake fitting and the return side of the air handler

Air flow will be provided by sequenced operation of the damper or equivalent technology

Objective(s):

Prevent air flow when none is desired

6.6102.4f

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

An accessible filter will be installed

Filter will be able to remove contaminants consistent with at least minimum efficiency reporting value (MERV) 6 or better when tested in accordance with ANSI/ASHRAE 52.2-2007

Filter or air cleaning systems that intentionally produce ozone will not be allowed

Objective(s):

Ensure occupant health and safety

Preserve integrity of the building envelope

6.6102.4g

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Occupant will be educated on how and when to change filter

Objective(s):

Ensure occupant health and safety

Preserve integrity of the building envelope

6.6102.4h

Desired Outcome:

Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Specification(s):

Total intake ventilation airflow will be measured

Objective(s):

Ensure airflow is as designed

6.6188.2a

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

Supply run feeding the register will be truncated as near to the supply plenum as possible

If directly connected to the plenum, the supply run will be truncated at the plenum

If connected to a Y or T branch system, the supply run will be truncated at the Y or T

Return grille located in garage will be removed in the same manner as supply

Objective(s):

Minimize duct leakage

6.6188.2b

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

All holes in sheet metal ducts will be patched with sheet metal and secured with sufficient screws to hold the patch flat without gaps

Holes left in any Y or T will be capped with sheet metal caps and fastened with at least three screws

Objective(s):

Ensure a secure and strong patch

6.6188.2c

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

All patches will be sealed with mastic meeting UL 181 and in accordance with manufacturer specifications

Objective(s):

Ensure an airtight patch

6.6188.2d

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

All abandoned ductwork will be removed from work area

Objective(s):

Provide a clean work site

6.6188.2e

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

Holes created by the removal of the register and boot will be patched and taped using material meeting local codes

Objective(s):

Prevent a fire hazard

6.6188.2f

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

Units will be tested for external static pressure (ESP) before and after work

If there is a significant rise in ESP, air flow testing will be required

Objective(s):

Ensure correct fan performance

6.6188.2g

Desired Outcome:

Safe removal of garage supply vents

Specification(s):

CAZ testing will be performed where combustion appliances are utilized

Objective(s):

Identify possible conditions that can cause unsafe equipment operating conditions

6.6205.1a

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Assessment will be done using ASHRAE 62.2 standard:

- Blower door test
- Fan flow measurements
- Calculations

Objective(s):

Determine the ventilation needs of the whole house

6.6205.1b

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Fan type will be capable of continuous operation and selected in accordance with ASHRAE 62.2 for:

- Sizing
- Climate considerations
- Control strategy
- Sone rating
- Durability

Fan will be ENERGY STAR qualified

Objective(s):

Determine proper fan selection

Minimize energy consumption during fan operation

6.6205.1c

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

No resistance greater than 3 pascals will exist between fan intake location with reference to the common area

Exhaust ventilation for common spaces will not be installed in bathrooms or bedrooms

Objective(s):

Ensure fresh air distribution to common areas

6.6205.1d

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

ASHRAE 62.2 will be referenced for climate considerations

Whole house mechanical net exhaust flow for hot-humid climate will not exceed 7.5 cubic feet per minute/100 square feet

Objective(s):

Maintain building durability

Protect occupant health

6.6205.1e

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

CAZ test will be performed where combustion appliances are utilized, where applicable

Objective(s):

Identify possible conditions that can cause unsafe equipment operating conditions

6.6205.1f

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Occupant will be educated on:

- Purpose of the ventilation system
- Proper operation and use of controls
- Cost and benefit of system
- Manual shut off

A label indicating the presence and purpose of the ventilation system will be included or a copy of the system operation guide will be posted at the electrical panel

Operation guide or label will be permanently attached and in full sight

Objective(s):

Ensure occupant is educated on the safe and efficient operation of the system

Deliver intended air exchange

6.6205.1g

Desired Outcome:

Provide primary ventilation for common spaces

Specification(s):

Total exhaust system airflow will be measured

Objective(s):

Ensure exhaust airflow is as designed

6.6288.2a

Desired Outcome:

Systems operate as quietly as possible

Specification(s):

System will be rated at a sound no greater than 1.0 sone

Objective(s):

Minimize noise

Maximize fan use

6.6288.2b

Desired Outcome:

Systems operate as quietly as possible

Specification(s):

Spot ventilation (local mechanical exhaust systems operated as needed by the occupant; e.g., range hood, bath fans) will be rated at a sound no greater than 3.0 sone

Objective(s):

Minimize noise

Maximize fan use

6.9901.1a

Desired Outcome:

To provide supplemental ventilation information—ASHRAE 62.2

Specification(s):

ASHRAE Standard 62.2-2013 and the calculation of the infiltration credit allow adjustments to primary ventilation fan flow rates for existing houses using a single fan.

Objective(s):

To provide supplemental ventilation information--ASHRAE 62.2

7.8003.1a

Desired Outcome:

Energy used for lighting reduced while maintaining adequate and safe lighting levels

Specification(s):

Window coverings (e.g., blinds, shades, moveable insulation) will be replaced or maneuvered to maximize useful daylight where appropriate

Active and passive daylighting will be properly oriented, designed, and installed where appropriate

Objective(s):

Reduce energy use without negative consequences (e.g., glare, unintentional heating)

7.8003.1b

Desired Outcome:

Energy used for lighting reduced while maintaining adequate and safe lighting levels

Specification(s):

All bulbs, fixtures, and controls will be appropriate for the intended application (e.g., enclosed, orientation, dimmable, potential for breakage, indoor and outdoor)

All bulbs, fixtures, and controls will be selected to provide the brightness and light quality required in that application (e.g., task lighting, trip-and- fall hazards, nightlights)

Selected equipment should have the highest level of efficiency within a technology [e.g., compact fluorescent lamp (CFL), LED]

All bulbs, fixtures, and controls will be ENERGY STAR rated where applicable

When possible, bulbs, fixtures, and controls will be selected that will facilitate the use of future lighting technologies (e.g., LEDs)

When incandescent bulbs cannot be replaced or when occupant chooses not to replace, a dimmer will be selected

Power quality will be evaluated before new lighting is selected

Light/lamp wattage should not exceed rated wattage of fixture

Bulb replacements will be chosen based on expected durability, light quality, and lifetime energy use of the bulb

Controls to turn off lights when not needed (e.g., no one in room) will be provided

All bulbs, fixtures, and controls will be UL-approved and installed in accordance with local code(s) and NFPA 70 National Electric Code

Fluorescent light ballasts containing polychlorinated biphenyls (PCBs) will be replaced in accordance with the EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades

Objective(s):

Provide improved lighting quality at lower energy use

Select equipment that will not be an unnecessary barrier to future technologies

Avoid inferior products and unsatisfied occupants

7.8101.1a

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Specification(s):

Installer prework assessment will be conducted to determine if plumbing needs corrected before installing high-efficiency shower head or faucet

Objective(s):

Verify scope of work

7.8101.1b

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Specification(s):

The rated flow of new shower heads will be 2.5 gallons per minute (GPM) or less

If multiple heads are provided, the total flow rate will not exceed 2.5 GPM

Aerator flow rate will be 2.2 GPM or less

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Reduce water and energy consumption

Ensure occupant satisfaction

7.8101.1c

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Specification(s):

Equipment will be installed in accordance with manufacturer specifications and meet all applicable building codes

Water quality will be evaluated for debris that may clog the equipment

Once installed, high-efficiency shower heads or faucet aerators will be tested to determine if equipment is tightened adequately to prevent leakage at the point of connection

If needed, shower diverter will be repaired or replaced

Any penetrations to the exterior of the home created by the installation of the equipment will be sealed

Any damage done to the house during installation will be repaired

Specific information about proper maintenance of the equipment will be provided to the occupant

Warranty information, operation manuals, and installer contact information will be provided to the occupant

Water flow that satisfies the occupant will be provided by all shower heads and faucet aerators

Occupant's acceptance of the shower head and/or aerator will be documented

Objective(s):

Reduce water and energy consumption

Ensure occupant satisfaction with water flow

Eliminate water leakage

Prevent water damage

7.8101.1d

Desired Outcome:

Energy and water use reduced while occupant needs for water flow maintained

Specification(s):

Replaced shower heads and faucet aerators will be recycled or disposed of properly

Objective(s):

Prevent the reuse of inefficient equipment and components

7.8102.1a

Desired Outcome:

Safe, reliable, and efficient hot water source selected that meets occupant needs at lowest possible cost of ownership and operation

Specification(s):

Equipment will provide sufficient, affordable, safe, and healthy hot water for the occupant in accordance with 2012 IRC P2801

Potential for solar hot water heating or other renewable energy systems will be assessed in selecting the hot water equipment

Potential for health and safety hazards (e.g., back drafting, flame rollout, obstructions) will be assessed in selecting equipment, and the cost of remedying such problems will be included in any cost and benefit calculations

If a combustion-based system is selected, it will be either direct vented or power vented, and ENERGY STAR® qualified or an Energy Factor (EF) of 0.58 or higher

If combustion equipment is selected, a low nitrogen oxide burner will be included

Equipment will be functional at high efficiency under all load conditions

Standby losses will be reduced to maximum potential

Fuel type will be selected based on affordability to occupant

Equipment will be freeze resistant or installed in a conditioned space

Efficiency of equipment will be maintained throughout life of system

Occupant control of hot water temperature will be provided on the equipment

The following will be determined from the occupant:

- Lifestyle
- Current and future needs
- Space considerations
- Fuel options
- Health and safety considerations
- Appliance options

- Maintenance and operation cost
- Return on investment concerns

Objective(s):

Save energy and water

Protect the environment

Identify appliance options based on the needs and wants of the occupant

- New gas water heaters must a minimum efficiency of .59 and new electric water hearthers must have a minimum efficiency of .91

7.8102.1b

Desired Outcome:

Safe, reliable, and efficient hot water source selected that meets occupant needs at lowest possible cost of ownership and operation

Specification(s):

Water heater will be selected based on performance requirements of the occupant, available fuel sources, energy efficiency, and total life cycle cost

In very cold climates, on-demand water heaters will be sized to meet the demand of water flow at very low water intake temperatures

When evaluating an existing thermal solar water heating system, a solar expert should be consulted

The proper installation and maintenance of solar hot water systems is provided in the Uniform Solar Energy Code (USEC) and 2012 IRC Chapter 23

Objective(s):

Ensure equipment meets the occupant's expectations while providing efficient energy and water use

7.8102.2a

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Health concerns in the removal and replacement of equipment (e.g., asbestos, other hazardous materials) will be identified

Written notification will be provided to occupants of the discovery of hazardous material, including contact information for regional EPA asbestos coordinator

Occupant will be asked to contract with an EPA-certified asbestos contractor to conduct abatement before equipment removal and replacement (occupant is responsible for abatement or remediation)

Objective(s):

Remediate health hazards using EPA- certified contractors

- The costs associated with testing and removal of asbestos or other hazardous materials are not eligible expenses in the *Nebraska Weatherization Assistance Program*.

7.8102.2b

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Accepted industry procedures and practices will be followed to:

- Remove old water heater and associated components in accordance with 2012 IRC R105.1 or authority having jurisdiction
- Seal any unused chimney openings and penetrations in accordance with 2012 IRC N1102.4.1.1 or authority having jurisdiction
- Remove unused oil tank, lines, valves, and associated equipment in accordance with 2012 IRC M2201.7 or authority having jurisdiction

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

- The costs associated with removal of oil tanks, lines, valves, and associated equipment are not eligible expenses in the *Nebraska Weatherization Assistance Program*.

7.8102.2c

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

New water heater and associated components will be installed by a licensed contractor to accepted industry standards, in accordance with the 2012 IRC and manufacturer specifications

The system will be installed to be freeze resistant

Any existing water leaks will be repaired before installation begins

Any penetrations to the exterior of the home created by the installation of the equipment will be sealed

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

7.8102.2d

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

An emergency drain pan will be installed with sides that extend a minimum of 4" above floor if leakage would cause damage to the home and in accordance with P2801.5 of the 2012 IRC

A $\frac{3}{4}$ " drain line or larger will be connected to tapping on pan and terminated in accordance with P2801.5.2 of the 2012 IRC

Objective(s):

Collect and safely dispose of water escaping from the storage tank

7.8102.2e

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

A potable water expansion tank will be installed on the cold water side

A direct connection with no valves between the storage tank and expansion tank will be installed in accordance with the 2012 IRC, authority having jurisdiction, and according to manufacturer specifications

Objective(s):

Protect the storage tank from expansion

7.8102.2f

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Correct temperature and pressure relief valve will be installed in compliance with P2803 of the 2012 IRC and according to manufacturer specifications

Temperature and pressure relief valve discharge tube will be installed in accordance with P2803.6.1 of the 2012 IRC

Objective(s):

Discharge excessive energy (pressure or temperature) from storage tank to safe location

7.8102.2g

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Dielectric unions will be installed in accordance with the 2012 IRC, authority having jurisdiction, and according to manufacturer specifications

Objective(s):

Break the stray voltage electrical circuit through the storage tank

7.8102.2h

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Backflow prevention will be installed in accordance with manufacturer specifications and all applicable codes

Objective(s):

Protect water supply from contamination

7.8102.2i

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

If additional tank insulation is installed, it will be rated a minimum of R-11 and will be installed to manufacturer specifications

If additional insulation is installed, it will be installed based on fuel type, making sure not to obstruct draft diverter, pressure relief valve, thermostats, hi-limit switch, plumbing pipes or elements, and thermostat access plates

The first 6' of inlet and outlet piping will be insulated in accordance with manufacturer specifications

Pipe insulation must remain 3" from gas water heater vent

Heat traps will be installed on the inlet and outlet piping where not provided by manufacturer

Objective(s):

Reduce standby loss from near tank piping and storage tank

Ensure insulation does not make contact with flue gas venting

7.8102.2j

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Electric or fossil fuel supply components will be installed to accepted industry standards as per NFPA 31 and 54, or NFPA 70 National Electric Code (NEC) for electric components, or authority having jurisdiction

Objective(s):

Provide sufficient fuel to the water heater, burner, or element

7.8102.2k

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Discharge temperature will be set not to exceed 120° or as prescribed by local code

Objective(s):

Ensure safe hot water supply temperature to fixtures

7.8102.2I

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

The following will be checked once the system has been filled and purged:

- Safety controls
- Combustion safety and efficiency
- Operational controls
- Fuel and water leaks
- Local code requirements

Commissioning will be in compliance with manufacturer specifications and relevant industry standards

Objective(s):

Ensure safe system function

Keep cost of ownership as low as possible

7.8102.2m

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Carbon monoxide alarms will be installed in each dwelling in accordance with ASHRAE 62.2 and authority having local jurisdiction

Occupant will be provided information regarding the health effects and risk of high CO concentrations, as well as a list of monitors that can provide more detail regarding CO levels

Ambient CO to be maintained at or under 10 ppm or within acceptable limits as comparable to outside concentrations

Objective(s):

Ensure occupant life safety; CO alarms are designed to detect levels at which occupants might become unable to evacuate

- The installation of Carbon Monoxide Detectors is required when none are present or the existing unit is inoperable and a combustion appliance(s) is present or the home has an attached garage.

7.8102.2n

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Completed work will be reviewed

Occupants will be educated on the safe and efficient operation and maintenance of the system, including:

- Adjustment of water temperature and target temperature in accordance with local code
- Periodic drain and flush
- Expansion tank and backflow preventer (no occupant maintenance required)
- Periodic inspection, maintenance, or replacement

Objective(s):

Ensure occupant is informed of the safe, efficient operation and maintenance of the system

7.8102.3a

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Health concerns in the removal and replacement of equipment (e.g., asbestos, other hazardous materials) will be identified

Written notification will be provided to occupants of the discovery of hazardous material, including contact information for regional EPA asbestos coordinator

Occupants will be asked to contract with an EPA-certified asbestos contractor to conduct abatement before equipment removal and replacement (occupant is responsible for abatement or remediation)

Objective(s):

Remediate health hazards using EPA- certified contractors

- The costs associated with testing and removal of asbestos or other hazardous materials are not eligible expenses in the *Nebraska Weatherization Assistance Program*.

7.8102.3b

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Accepted industry procedures and practices will be followed to:

- Remove old water heater and associated components in accordance with 2012 IRC R105.1
- Seal any unused chimney openings and penetrations in accordance with 2012 IRC N1102.4.1.1
- Remove unused oil tank, lines, valves, and associated equipment in accordance with 2012 IRC M2201.7

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

- The costs associated with removal of oil tanks, lines, valves, and associated equipment are in eligible expenses in the *Nebraska Weatherization Assistance Program*.

7.8102.3c

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

A new water heater and associated components will be installed to accepted industry standards, in accordance with the 2012 IRC, authority having jurisdiction, and manufacturer specifications

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction

Objective(s):

Ensure the safety of the workers and occupants

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

7.8102.3d

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

An emergency drain pan will be installed with sides that extend a minimum of 4" above floor if leakage would cause damage to the home and in accordance with P2801.5 of the 2012 IRC

A $\frac{3}{4}$ " drain line or larger will be connected to tapping on pan and terminated in accordance with P2801.5.2 of the 2012 IRC

Objective(s):

Collect and safely dispose of water escaping from the storage tank

7.8102.3e

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Correct temperature and pressure relief valve will be installed in compliance with P2803 of the 2012 IRC and according to manufacturer specifications

Temperature and pressure relief valve discharge tube will be installed in accordance with P2803.6.1 of the 2012 IRC

Objective(s):

Discharge excessive energy (pressure or temperature) from storage tank to safe location

7.8102.3f

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Dielectric unions will be installed to accepted industry standards, in accordance with the 2012 IRC, and according to manufacturer specifications

Objective(s):

Break the stray voltage electrical circuit through the storage tank

7.8102.3g

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Backflow prevention will be installed in accordance with manufacturer specifications

House water pressure and volume will be verified as sufficient to be in accordance with manufacturer specifications

All applicable codes will be followed

Objective(s):

Protect the water supply from contamination

Provide for sufficient volume and pressure

7.8102.3h

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Any accessible hot water lines at the appliance will be insulated to meet 2012 IRC N1103.4.2 or local requirements, whichever is greater

Objective(s):

Reduce line losses

7.8102.3i

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Recommendations will be made to install all on-demand appliances as sealed combustion

If not possible:

Combustion and ventilation (excess air) requirements of gas-fired appliances, including provision of outside and inside air to account for building tightness, will be provided

The minimum required volume shall be 50 cubic feet per 1,000 Btu/h in accordance with 2012 IRC G2407.5.1

If needed, additional combustion air will be provided in accordance with 2012 IRC G2407

Objective(s):

Ensure adequate combustion air for operation of the appliance

7.8102.3j

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Combustion byproducts will be removed in accordance with Chapter 24 of the International Residential Code (2012 IRC) and manufacturer specifications

Objective(s):

Ensure the safety and durability of the venting system

7.8102.3k

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with BPI-1100-T-2012

If combustion is not in compliance with BPI-1100-T-2012, diagnostics and adjustments will be done to manufacturer specifications or local codes

Objective(s):

Confirm that combustion is occurring safely with maximum efficiency

7.8102.3I

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Electric or fossil fuel supply components will be installed to accepted industry standards as per Chapter 24 of the 2012 IRC, the NFGC, NFPA 31, 54, and 58 for gas and oil, or NFPA 70 National Electric Code for electric

Energy input required by the appliance will be in accordance with manufacturer specifications

Objective(s):

Provide sufficient fuel to the water heater burner or element

7.8102.3m

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

The volume and pressure of the water supplied to the appliance will be in accordance with manufacturer specifications

Objective(s):

Provide sufficient volume and pressure of water to the appliance

7.8102.3n

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Discharge temperature will be set in accordance with manufacturer instructions and in compliance with local codes

Use extreme caution when temperature setting is above 120°F

Objective(s):

Ensure safe hot water supply temperature to fixtures

7.8102.3o

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

The following will be checked once the system has been connected and filled:

- Safety controls
- Combustion safety and efficiency
- Operational controls
- Fuel and water leaks
- Cycle unit
- Local code requirements

Manufacturer specifications and all relevant industry standards will be met in commissioning

Objective(s):

Ensure system functions safely with lowest possible cost of ownership

7.8102.3p

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

All homes with combustion appliances or an attached garage will have a carbon monoxide (CO) alarm

Objective(s):

Ensure occupant health and safety

7.8102.3q

Desired Outcome:

Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Specification(s):

Completed work will be reviewed

Occupants will be educated on the safe and efficient operation and maintenance of the system, including:

- Adjustment of water temperature and target temperature in accordance with local code
- Operation of backflow preventer and pressure regulator (no occupant maintenance required)
- Importance of keeping operating manuals accessible

Objective(s):

Ensure occupant is informed of the safe, efficient operation and maintenance of the system

7.8103.1a

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Combustion safety testing will be performed in accordance with the Health and Safety Chapter of the Standard Work Specifications for Single-Family Housing or other equivalent practice

Electrical components will be verified to comply with NEC (e.g., no electrical box connector, no disconnect, improperly sized breaker and wire)

Objective(s):

Identify potential health and safety issues

7.8103.1b

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Inspection will be conducted to show compliance with the 2012 IRC, including but not limited to:

- Water or fuel leaks
- Damaged wiring
- Venting issues with draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence)
- Corrosion (e.g., rust, mineral deposits)
- General condition of components

Objective(s):

Determine needed repairs or maintenance

7.8103.1c

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Water heater storage tanks shall have a minimum R-value of R-24

Added insulation will not obstruct the unit's draft diverter, pressure relief valve, thermostats, hi-limit switch, plumbing pipes or elements, and thermostat access plates

The first 6' of inlet and outlet piping will be insulated in accordance with 2012 IRC N1103.4.2 or local requirements, whichever is greater

Objective(s):

Reduce standby losses from near tank piping and storage tank

Ensure insulation does not make contact with flue gas venting

7.8103.1d

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

A potable water expansion tank will be installed on the cold water side

Tanks that leak or have excessive corrosion will be replaced

A direct connection with no valves from the expansion tank to the storage tank will be installed

Connection will be properly supported with strapping

An expansion tank drain will be included in nonbladder tanks

Tank will be installed to accepted industry standards, in accordance with the 2012 IRC and according to manufacturer specifications

Tanks that are completely full of water will be drained and refilled before being replaced or repaired

Expansion tanks with bladders will have air charged to the manufacturer pressure requirements while water is not present in the tank

Bladder tanks with water inside of the air bladder will be replaced in accordance with manufacturer specifications

All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards

Objective(s):

Absorb water expansion of the system

7.8103.1e

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Correct temperature and pressure relief valve will be installed in compliance with P2803 of the 2012 IRC and according to manufacturer specifications

Temperature and pressure relief valve discharge tube will be installed in accordance with P2803.6.1 of the 2012 IRC

Objective(s):

Discharge excessive energy (pressure or temperature) from storage tank to safe location

7.8103.1f

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Occupants will be advised to keep records of all maintenance done to their system

Copies of or access to installation and operation manuals will be provided

Objective(s):

Provide a history of system installation and maintenance to improve chance of successful future maintenance or repair

7.8103.1g

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Carbon monoxide alarms will be installed in each dwelling in accordance with ASHRAE 62.2 and authority having local jurisdiction

Occupant will be provided information regarding the health effects and risk of high CO concentrations, as well as a list of monitors that can provide more detail regarding CO levels

Objective(s):

Ensure occupant life safety

Inform occupant regarding possible CO hazards

- The installation of Carbon Monoxide Detectors is required when none are present or the existing unit is inoperable and a combustion appliance(s) is present or the home has an attached garage.

7.8103.1h

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Completed work will be reviewed

Occupants will be educated on the safe and efficient operation and maintenance of the system, including:

- Adjustment of water temperature and target temperature in accordance with local code
- Periodic drain and flush
- Periodic inspection, maintenance, or replacement of anode rod

Objective(s):

Ensure occupant is informed of the safe, efficient operation and maintenance of the system

7.8103.2a

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Combustion safety testing will be performed in accordance with the Health and Safety Chapter of the Standard Work Specifications for Single-Family Housing or other equivalent practice

Electrical components will be verified to comply with NFPA 70 National Electric Code (e.g., no electrical box connector, no disconnect, improperly sized breaker and wire)

Objective(s):

Identify potential health and safety issues

7.8103.2b

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Inspection will be conducted to show compliance with the 2012 IRC, including but not limited to:

- Water or fuel leaks
- Damaged or missing pipe insulation and tank insulation, where applicable
- Damaged wiring
- Venting issues with draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence)
- Corrosion (e.g., rust, mineral deposits)
- General condition of components

Objective(s):

Determine needed repairs or maintenance

7.8103.2c

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Correct temperature and pressure relief valve will be installed in compliance with P2803 of the 2012 IRC and according to manufacturer specifications

Temperature and pressure relief valve discharge tube will be installed in accordance with P2803.6.1 of the 2012 IRC

Objective(s):

Discharge excessive energy (pressure or temperature) from storage tank to safe location

7.8103.2d

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with BPI-1100-T-2012

If combustion is not in compliance with BPI-1100-T-2012, diagnostics and adjustments will be done to manufacturer specifications or local codes

Objective(s):

Perform combustion testing

7.8103.2e

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

If sealed combustion has not been installed:

- Combustion and ventilation (excess air) requirements of gas-fired appliances, including provision of outside and inside air to account for building tightness, will be provided
- The minimum required volume will be 50 cubic feet per 1,000 Btu/h in accordance with 2012 IRC G2407.5.1
- If needed, additional combustion air will be provided in accordance with 2012 IRC G2407

Objective(s):

Ensure adequate combustion air for operation of the appliance

7.8103.2f

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Condition of venting will be inspected in accordance with Section 504 IFGC, NFPA 54, or NFPA 58 for gas water heaters or NFPA 31 for oil water heaters, and authority having local jurisdiction

Objective(s):

Verify proper venting of flue gases

7.8103.2g

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Condition of fuel supply components will be checked in accordance with NFPA 31 for oil, NFPA 54 for gas, NFPA 58 for propane, or NFPA 70 National Electric Code for electric, and authority having jurisdiction

Objective(s):

Verify sufficient fuel to the water heater burner and element

7.8103.2h

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Water supplied to the appliance will be of sufficient volume and pressure to be in accordance with manufacturer specifications

Objective(s):

Verify sufficient volume and pressure of water to the appliance

7.8103.2i

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Discharge temperature will be set not to exceed 120°F or in accordance with local code, whichever is lower

Objective(s):

Ensure safe hot water supply temperature to fixtures

7.8103.2j

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

The following will be tested:

- Safety controls (e.g., water, air pressure switches)
- Combustion safety and efficiency
- Operational controls
- Fuel and water leaks
- Unit runs through complete cycle
- Local code requirements

Manufacturer specifications and all relevant industry standards will be met

Objective(s):

Ensure system functions safely with lowest possible cost of ownership

7.8103.2k

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Occupants will be advised to keep records of all maintenance done to their system

Copies of or access to installation and operation manuals will be provided

Objective(s):

Improve chance of successful future maintenance or repair

7.8103.2I

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

All homes will have a carbon monoxide (CO) alarm

Objective(s):

Ensure occupant health and safety

- The installation of Carbon Monoxide Detectors is required when none are present or the existing unit is inoperable and a combustion appliance(s) is present or the home has an attached garage.

7.8103.2m

Desired Outcome:

Safe, reliable, and efficient operation of the appliance maintained

Specification(s):

Completed work will be reviewed

Occupants will be educated on the safe and efficient operation and maintenance of the system, including:

- Adjustment of water temperature
- Target temperature in accordance with local code

Objective(s):

Ensure occupant is informed of the safe, efficient operation and maintenance of the system